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ABSTRACT

This congressional report contains testimony given at the first of a series of comprehensive hearings on the impact of automation on employment and the workplace. Included among those agencies and organizations represented at the hearing were the following: the International Association of Machinists and Aerospace Workers; the American Federation of Labor/Congress of Industrial Organizations; the Working Women Education Fund; Unimation, Inc.; the Chase Manhattan Bank; the National Productivity Group; Advanced Office Concepts; the Library of Congress; the GCA Corporation; and the United States General Accounting Office. (MN)

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# NEW TECHNOLOGY IN THE AMERICAN WORKPLACE

## HEARING

BEFORE THE

SUBCOMMITTEE ON LABOR STANDARDS

OF THE

## COMMITTEE ON EDUCATION AND LABOR
## HOUSE OF REPRESENTATIVES

NINETY-SEVENTH CONGRESS

SECOND SESSION

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HEARING HELD IN WASHINGTON, D.C., ON
JUNE 23, 1982

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# NEW TECHNOLOGY IN THE AMERICAN WORKPLACE

WEDNESDAY, JUNE 23, 1982

HOUSE OF REPRESENTATIVES,
SUBCOMMITTEE ON LABOR STANDARDS,
COMMITTEE ON EDUCATION AND LABOR,
*Washington, D.C.*

The subcommittee met, pursuant to notice, at 9:30 a.m., in room 2261, Rayburn House Office Building, Hon. George Miller (chairman of the subcommittee) presiding.

Members present: Representatives Miller, Johnston, and Ratchford.

Staff present: Dennis Houlihan, research assistant; Vincent Trivelli, research assistant; Grace Lewis, staff assistant; and Bruce Wood, minority associate labor counsel.

MR. MILLER. The Subcommittee on Labor Standards of the full Education and Labor Committee will come to order for the purpose of conducting the first of a series of comprehensive hearings on the impact of automation on employment and the workplace.

Since the last major inquiry in 1961, advances in computer and microelectronic technology have led society into the initial stages of a second industrial revolution. It is for that reason that this subcommittee has convened, for the purposes of receiving testimony from the various persons that will be involved in the revolution and to try to provide Congress some insight as to the impacts on different segments of our society.

[Opening statement of Congressman Miller follows:]

OPENING STATEMENT OF HON. GEORGE MILLER, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF CALIFORNIA, AND CHAIRMAN, SUBCOMMITTEE ON LABOR STANDARDS

This hearing is the first of a comprehensive series of hearings on the impact of automation on employment and the workplace.

Since the last major inquiry in 1961, advances in computer and micro-electronic technology have led society into the initial stages of a second industrial revolution. A Committee of the National Academy of Sciences predicts its impact on society "could be even greater than that of the original revolution."

There is no way, nor any need, to resist this technological revolution. But our failure to prepare our workers and students for their role could be ruinous to our nation's economy. Colin Norman, author of "Micro-Electronics at Work: Productivity in the World Economy" has predicted that:

"Countries that move most rapidly in using technology will gain a competitive advantage in international markets."

We have no alternative but to encourage the development of new workplace technology in order to increase productivity and enhance our competitiveness in international trade. At the same time, however, we must ensure that the burdens of adjusting to new technology do not fall inequitably. In our second industrial revolution, unlike the first, the rights and interests of workers must be protected.

Today, neither the Congress nor the Administration has directed adequate attention toward the major policy questions related to new technology in the workplace: automation and robotry; education; job training; the effects of tax incentives; the impact on women workers; occupational health concerns; income and retirement policies; and job security.

We have already been warned of some employment and workplace effects of automation and new technology. A General Accounting Office study issued last month reports that this new wave of automation is causing the displacement of workers from their jobs, changing the nature of some jobs, and simultaneously creating new occupations.

A healthy, competitive economy will depend on the availability of properly trained workers to fill the available jobs. One of the key policy considerations must be the education and training of students and workers for the jobs they will perform in coming decades. At a San Francisco field hearing on my bill H.R. 5820, the Electronic and Computer Technician Vocational Education Incentives Grants Act, members of this Committee heard from representatives of industries which are at the forefront of developing these new technologies. Educators, union representatives and industry leaders all agreed that students require special educational training, and that displaced workers will require substantial retraining in order to qualify for jobs in emerging fields.

The Subcommittee will investigate changes in the nature of the workplace environment resulting from advanced technology. Advances in robotics and manufacturing technology have the potential to protect many factory workers from dangerous and undesirable jobs. New telecommunication and office automation systems offer opportunities for greater flexibility in scheduling the hours and location of work.

Information collected by this Subcommittee will aid Congress in consideration of economic revitalization, education, tax and job training policies which will shape our nation's industrial and ecomonic future.

This first hearing offers us an overview of the technology-employment debate, the role of the Federal Government in encouraging productivity growth through technological change, and the application of new technology in the office and the factory.

Mr. MILLER. Our first witness will be Mr. Brian Usilaner, who is the Associate Director for the National Productivity Group, and he will be accompanied by Mr. Chick and Mr. Fritts.

**STATEMENT OF BRIAN USILANER, ASSOCIATE DIRECTOR, NATIONAL PRODUCTIVITY GROUP, ACCOMPANIED BY ED FRITTS, GROUP DIRECTOR, ACCOUNTING AND FINANCIAL MANAGEMENT DIVISION, AND MOREY CHICK, SENIOR EVALUATOR, ACCOUNTING AND FINANCIAL MANAGEMENT DIVISION**

Mr. USILANER. I am Brian Usilaner and this is Ed Fritts, who heads up our private sector productivity work and Morey Chick is a project manager. Mr. Chick took the lead in the staff study on the impact of automation on the work force.

I would like to provide for the record my full statement and summarize the major points.

The General Accounting Office has had a continuing long-term interest in the subject of productivity, and that is why we feel these hearings are important. We have done a diversity of studies for the Congress ranging from how the executive branch should better organize itself for productivity improvement in the private sector to such areas as robotics and automated manufacturing.

In your letter of invitation and in meetings with your staff, it is clear that the subcommittee is concerned about the Federal role in fostering automation as a way of improving national productivity and the impact of automation on the work force. My statement, based on GAO's past and ongoing work in the area, addresses these concerns.

While the private sector properly must assume primary responsibility for developing and implementing automation technology, the Federal Government has had and will continue to play some role. We believe the Federal Government should develop policies and programs to encourage continued growth in automation and address problems that automation may create.

In my statement today I will summarize: the importance of automation to productivity and the economy, the barriers to and stimulators of the rapid adoption of automation, potential adverse effects on the work force, current and potential Government roles, and the need for an overall plan to guide Federal policies and programs related to automation.

I don't need to tell this committee the problems productivity is causing in this country, the declining growth rates of the past several years which have put a significant damper on our overall economy.

A key factor in enhancing productivity in this country is automation. Our lag in implementing automation in comparison with other industrial nations is in part reflected in our declining productivity. Moreover, unless automation is stimulated, the U.S. economy stands to lose ground in two important markets: automated systems and equipment, totaling billions of dollars annually, and the consumer goods markets, totaling hundreds of billions of dollars annually.

Numerous barriers impede the rate of adoption of this automation technology, but stimulators also exist which motivate both producers and users of the technology. Thus, the question today is not whether but, rather, how rapidly automation will expand.

The barriers to more rapid implementation of automated technologies in the United States can be categorized as technical, financial, and social.

Technical barriers are encountered in getting automated equipment to function properly. These can include a lack of technical expertise to design and implement automated technologies; problems and costs in developing the software to make the systems work; an absence of the necessary standardization, and a shortage of qualified persons to operate and service automated equipment and systems.

People who can develop the software needed to make automation work are scarce and much in demand. Also in demand are production and manufacturing engineers who can design a plant to accommodate automated equipment in the most productive manner possible. Shortages of the kind of expertise needed for systems design work are likely to continue for several years, until university curricula are established to offset the shortages.

Financial barriers involve decisions to invest in new capital equipment such as automated devices. Some of these barriers are: the current high interest rates; the tendency of business to focus on short-run needs; other capital investment considerations such as cash flow, cost recovery, and the risk involved in investing in new, untried equipment, and the uncertainty of the marketplace.

Finally, there are social barriers, which are just as important as the other two, based on human resistance to change. For example, a union may be apprehensive about the impact that automation

can have on its members and may resist it, for a time, by attempting to protect its membership through restrictive labor-management contract clauses. Even managers themselves are apprehensive about using new equipment or handling other changes that might follow.

Despite these barriers to automation, the national economic problems now being faced—such as rising labor costs, decreasing competitiveness, and shrinking market shares in many industries—stimulate both the development and use of automation technology. Potential users are seeking ways to reduce costs and increase market share and profits. Automation technology is seen as a possible solution.

Simultaneously, the market potential for automation technology is motivating producers to create new and better products, systems, and support services.

As automation technologies mature and competition among vendors increase, market forces and human ingenuity are likely to cause a proliferation of more and better systems, affordable and useful to a wider segment of the economy.

While it appears that the Nation is beginning an exponential growth curve in automation technology, some of the barriers may persist for several years.

The potential for job displacement is the other side of the coin that must be considered when discussing advancing automation in the United States. We are now seeing renewed concern about automation's effect on employment because of its expanding uses in virtually all sectors of the U.S. economy. We addressed this in a recently issued staff study entitled "Advances in Automation Prompt Concern Over Increased U.S. Unemployment."

Job displacement can be long run or short run. Longrun displacement means an overall, relatively permanent increase in unemployment levels. Shortrun displacement refers to a temporary loss of jobs until new jobs are created and filled by retraining workers initially displaced. Shortrun displacement is occurring now and will continue, at least for some time. Almost all experts agree on this.

We found little agreement on the long-term displacement effects of automation, and for good reasons. Some experts believe that unemployment levels will not increase because automation will create new jobs that will equal or exceed those jobs eliminated. The Department of Labor agrees with this position. It assumes a 4 to 6 percent unemployment rate for 1990, and projects an increase in jobs of up to 31 percent as compared to 1978.

Others believe longrun unemployment levels will exceed the 4 to 6 percent levels because automation will create structural changes in the work force. This view presumes that, first, the increased capacity to produce goods and services through automation will be more than the increase in demand for them, second, the economy increasingly will be unable to absorb displaced workers, and third, the shift in skill requirements caused by automation can result in a mismatch between the skills required in the new jobs created and capabilities of persons available for work.

Three basic unknowns account for disagreement of the long-run employment issue: the rate of diffusion of the technology, forces

other than automation that affect unemployment levels, and the lack of comprehensive data today about the overall net effect of automation.

Current and potential Federal roles for encouraging and responding to private sector adoption of automation: The Federal Government's involvement in automation in private industry falls into two major categories: efforts to encourage and facilitate automation, and responsibilities to protect the work force from potential negative consequences of rapid automation.

Under the first category there are at least five types of Federal involvement: financial incentives for private sector action, Federal research responsibilities, technology transfer mechanisms, Federal effort to support engineering education, and the development of standards to facilitate integration of diverse components of automation systems. There are unresolved questions about how well these Government roles are being carried out.

The other major category of the Government's involvement pertains to the potential impact of automation on the work force. This area is also characterized by controversy over the appropriate Federal roles relating to labor displacement, skills training and retraining, and potential friction between labor and management.

In addition, comprehensive information on displacement, job movement, and skills shifts caused by automation is vital to addressing these issues. So far, however, the Department of Labor has only a limited program for collecting, analyzing, and disseminating this information.

Federal policies that deal with automation, the work force, and productivity are often criticized as being ad hoc and not coordinated. This criticism is predictable, given the myriad issues involved, the fact that all of them are interrelated and that the rules and policymaking responsibiliaties to address them are dispersed among numerous congressional committees as well as various Federal agencies. Within this context, maintaining a proper balance in national policies is extremely difficult.

We believe the issues in automation demonstrate the need for a planned strategy or framework within which the dispersed responsibilities can be carried out in a more structured or systematic way. Automation, for example, demonstrates the need to balance policies to both overcome technological barriers and address social and employment issues as well.

We are aware of numerous legislative proposals to address training, retraining, relocation of workers, and various technological and financial barriers to automation, as well as the total subject of productivity in the private sector. So that we do not approach these issues on a piecemeal basis, we need a balanced national approach to automation.

As a part of this approach, we believe an overall plan and strategy is needed in the Federal Government that, as a minimum, would assure first, coordination of Federal policies and programs, second, a means of evaluating their impact, third, the collection, analysis, and dissemination of comprehensive and specific information about automation and jobs, fourth, a mechanism for continuing dialog among affected sectors, and fifth, the assignment of responsibility to see that necessary actions are carried out.

In previous reports of the GAO and in congressional testimony, we have expressed the need for a Federal focal point to guide and coordinate Federal programs aimed at improving national productivity and to work closely with the private sector to develop a productivity plan. Such a plan would recognize automation as an important variable in national productivity growth. Our work in automation further reinforces the need for such a plan.

In conclusion, of all the factors that affect people's lives in the 1980's, few will have a bigger impact than automation. Our national need to become more competitive in the marketplace is creating a sense of urgency to push automation at a revolutionary rate.

Automation provides an opportunity to become more competitive, but it also presents a major challenge in making the American labor force capable of working effectively in a highly automated environment. Whether automation brings prosperity or new hardships may depend critically on how quickly and how well we develop and put into place the proper balance of policies and programs that stimulate automation and prepare the work force.

This concludes my statement, Mr. Chairman. I will be happy to respond to your questions.

[Prepared statement of Brian Usilaner follows:]

PREPARED STATEMENT OF BRIAN L. USILANER, ASSOCIATE DIRECTOR, ACCOUNTING AND FINANCIAL MANAGEMENT DIVISION, NATIONAL PRODUCTIVITY GROUP, U.S. GENERAL ACCOUNTING OFFICE

Mr. Chairman and members of the Subcommittee, thank you for the opportunity to appear before you and discuss automation in the workplace. In your May 6, 1982, letter and in meetings with your staff, it is clear that the Subcommittee is concerned about the Federal role in fostering automation as a way of improving national productivity and the impact of that automation on the work force. My statement, based on GAO's past and ongoing work in the area, addresses these concerns.

Automation is defined as the use of microelectronic and other technologies that either reduce the need for people, enable people to perform more work, or perform functions that people cannot. Automation is important to the Nation's economic well-being by improving productivity and product quality in the office and in the factory. Automation can be an important factor in productivity improvement. At the same time, rapid, widescale adoption of automation exacerbates such problems as labor displacement, skill shortages, geographic dislocations, time lags in education and technical training, and labor/management bargaining.

While the private sector properly must assume primary responsibility for developing and implementing automation technology, the Federal Government has had and will continue to play some role. We believe the Federal Government should develop policies and programs to encourage continued growth in automation and address employment problems that automation may create. Although we are not prepared to offer specific recommendations at this time, we do see the need for a more organized and systematic Federal approach to automation.

In my statement today, I will discuss: The importance of automation to productivity and the economy; the barriers to and stimulators of the rapid adoption of automation; potential adverse effects on the work force; current and potential Government roles; and the need for an overall plan to guide Federal policies and programs to both stimulate growth relating to automation as well as its impact on the work force.

## IMPORTANCE OF AUTOMATION TO PRODUCTIVITY AND THE ECONOMY

A key factor in productivity and economic competitiveness is automation. Our lag in implementing automation in comparison with other industrial nations is in part reflected in our declining productivity.

Declining national productivity is a matter of increasing concern. In 3 of last 5 years, labor productivity has declined. In 1981, it showed a modest increase of 0.9 percent, but the 1.0 percent decline in the first quarter of 1982 offsets any grounds for optimism. The problem is both serious and long term.

Growth in the capital/labor ratio, which has been a key source of labor productivity, is increasingly an important barometer of investments in automation. The capital stock grew at relatively high rates in this country over the 1947-73 period, compared its growth since then. The Japanese, who are making extensive use of automated manufacturing technology, have maintained a high relative capital/labor ratio, resulting in greater output per worker. For example, between 1973 and 1980, American output per hour rose 1.7 percent per year, compared to 6.8 percent by the Japanese. If this disparity continues, the U.S. economy stands to lose ground in two important markets: automated systems and equipment, totaling billions of dollars annually, and the consumer goods market, totaling hundreds of billions of dollars annually.

Even more ominous is the prospect that further losses of the producer goods market could signal an over reliance on foreign producers for the automation systems and components that sustain our industrial base in general and our defense industrial base in particular. Foreign machine tool manufacturers, for example, have doubled their share of the American market in the last 7 years. The Japanese expect worldwide sales of their robots to increase from $392 million in 1979 to as much as $5 billion by 1990. These issues are creating a sense of urgency on the part of American industry, labor, and Government to push automation at a revolutionary rate.

### BARRIERS AND STIMULATORS TO RAPID AUTOMATION

Numberous barriers impede the rate of adoption of this automation technology, but stimulators also exist which motivate both producers and users of the technology. Thus, the question today is not whether, but rather how rapidly automation will expand. As evidenced by a growing number of companies that are entering or expanding their product lines in the producer goods industry—such as robots, office systems, and others, rapid growth is clearly anticipated. Whether the growth is as fast as it could be depends on how effective we are in overcoming the barriers to growth.

The barriers to more rapid implementation of automated technologies in the United States can be categorized as technical, financial, and social.

Technical barriers are encountered in getting automated equipment to work. These can include: A lack of technical expertise to design, debug, and implement automated technologies; problems and costs in developing the software to make the systems work; an absence of the necessary standardization; a shortage of qualified persons to operate and service automated equipment and systems; and technology transfer inefficiencies and problems.

People who can develop the software needed to make automation work are scarce and much in demand. Also in demand are production and manufacturing engineers who can design a plant to accommodate automated equipment in the most productive manner possible. For example, optimum results of automated systems often come about by completely redesigning the traditional manufacturing processes. Unless this is fully understood by American managers, costly mistakes can be anticipated by incorporating bits and pieces of automation into their outdated layouts. Shortages of the kind of expertise needed for systems design work is likely to continue for several years, until university curricula are established to offset the shortages.

Financial barriers arise from the necessity to invest in new capital equipment such as automated devices. Some of these barriers are: The current high interest rates; the tendency of business to focus on short-run needs; other capital investment considerations such as cash flow, cost recovery, and the risk involved in investing in new, untried equipment; and the uncertainty of the marketplace.

The investment objective of many companies is to recoup the cost of equipment in less than 3 years—much too short to properly assess long term benefits of automation. The cash flow position of a company is also crucial in its decision whether to invest in new equipment.

Finally, there are social barriers based on human resistance to change. For example, a union may be apprehensive about the impact that automation can have on its members and may resist it, for a time, by attempting to protect its membership through restrictive labor-management contract clauses. Even managers themselves are apprehensive about using new equipment or handling other changes that might follow. Initial consumer resistance to automatic checkouts at supermarkets and to electronic funds transfers are good examples of human mistrust of automation.

Despite these barriers to automation, the national economic problems now being faced—rising labor costs, decreasing competitiveness, shrinking market shares—

stimulate both development and use of automation technology. Potential users are seeking ways to reduce costs and increase market share and profits. Automation technology is seen as a possible solution.

Simultaneously, the market potential for automation technology is motivating producers to create new and better products, systems, and support services. Automation packages—hardware and software—are becoming more comprehensive and perform more functions. Competition, including that from foreign technology vendors, is resulting in packages that are more affordable. For example, ready for use computer-aided design systems, complete with software programs, are currently available for under $100,000, making them affordable to a much broader segment of the manufacturing sector.

As automation technologies mature and competition among vendors increases, market forces and human ingenuity are likely to cause a proliferation of more and better systems—affordable and useful to a wider segment of the economy. Available evidence suggests this is already taking place. For example, sales projections for components of the automation field range from 30 to 50 percent compounded annual growth. Sales growth during the last 2 years adds validity to these projections.

Thus, while it appears that some of the barriers described earlier are being overcome and that the Nation is beginning an exponential growth curve in automation technology development, adoption, and use, other barriers may persist for several years. Understanding the implications of automation growth and barriers in relation to Federal policies and programs will require close attention and analysis.

### POTENTIAL ADVERSE EFFECTS ON THE WORK FORCE

The potential for job displacement is the other side of the coin that must be considered when discussing advancing automation in the United States. The term displacement means different things to different people. We define it as persons laid off or unable to find jobs because of automation.

We recently issued a staff study entitled "Advances in Automation Prompt Concern Over Increased U.S. Unemployment." This study discusses the views of many persons involved in this area about both short-run and long-run unemployment, and explains why people disagree about what is going to happen in the future.

The concern over whether automation will cause high rates of unemployment is not new. In 1964 the Congress established the National Commission on Technology, Automation, and Economic Progress. One of the main reasons the Commission was established was the concern over the possible employment impact of the use of computers. The Commission concluded in 1966 that automation would not cause severe unemployment over the next 10 years and, in fact, it did not.

We are not seeing renewed concern about automation's effect on employment because of its expanding uses in virtually all sectors of the U.S. economy, uses made possible by the advent of microelectronics. Microelectronic computers are smaller, less costly, and more easily used. Microelectronics has made automation usable in many more applications and is the main force behind the increased use of automation in the manufacturing and service sectors.

Job displacement can be long-run or short-run. Long-run displacement means an overall, relatively permanent increase in unemployment levels. Short-run displacement refers to a temporary loss of jobs until new jobs are created and filled by retraining workers initially displaced. Short-run displacement is occurring now and will continue, at least for some time. Almost all the experts agree on this. Two examples of short-run displacement are: The use of automated typesetting equipment which has led to the lay-off of many highly skilled and well-paid typesetters; and the increasing use of robotics and other automated equipment in automobile manufacturing.

Recently published predictions have cited the potential loss of millions of jobs in the manufacturing sector because of the use of robotics. Short-run displacement is also occurring in or expected to affect many other occupations including telephone operators, postal workers, textile and railroad employees, inspectors, middle managers, office workers, and warehouse drivers. At the same time, new and existing occupations are expected to increase because of the advent and diffusion of automation. The increased demand for persons to fill these additional jobs is a direct result of automation and include many jobs is a direct result of automation and include many jobs, including those in engineering and computer science. In addition, in the short-run, many people, although keeping their jobs, are being asked to perform new functions requiring new skills. As we noted in our staff study, many kinds of occupations will be affected, both high- and low-skilled.

We found little agreement on the long-term displacement effects of automation, and for good reasons. Some experts believe that unemployment levels will not increase because automation will (1) assist U.S. industries in fighting foreign competition, (2) create new jobs that will equal or exceed those jobe eliminated, and (3) foster economic growth which, in itself, will create more jobs. The Department of Labor assumes a 4 to 6 percent unemployment rate for 1990 and projects an increase in overall jobs of up to 31 percent as compared to 1978.

Others believe long-run unemployment levels will not reach these targets because automation will create structural changes in the work force. This view presumes that (1) the increased capacity to produce goods and services through automation will be more than the increase in demand for them, (2) the economy increasingly will be unable to absorb displaced workers because all sectors will be affected simultaneously, (3) the shift in skill requirements caused by authomation can result in a mismatch between the skills required in the new jobs created and the backgrounds and capabilities of persons unemployed and available for work.

Three basic unknowns account for disagreement of the long-run unemployment issue: The rate of diffusion of the technology; other forces that affect unemployment levels; and the lack of comprehensive data today about the overall net effect of automation.

The rate of diffusion depends on how rapidly the barriers to implementation are overcome. Other forces that affect unemployment include foreign competition, consumer preferences, and population and personal income growth, amoung others. Absence of specific and comprehensive information about automation's net impact on jobs in this country makes accurate predictions impossible. The Department of Labor does not have the information, nor does anyone in the private sector.

Automation will continue to have an effect on the work force. It will require workers to acquire new skills and will result in short-term displacement. Whether automation will result in long-term unemloyment is simply unknown.

## CURRENT AND POTENTIAL FEDERAL ROLES FOR ENCOURAGING AND RESPONDING TO PRIVATE SECTOR ADOPTION OF AUTOMATION

The Federal Government's involvement in the automation of private industry falls into two major categories: efforts to encourage and facilitate automation and responsibilities to protect the work force from potential negative consequences of rapid automation. The extent to which the Government fulfills these rolls is often overshadowed by unresolved questions.

Federal efforts to encourage automation fall into at least five types of involvement: Financial incentives for private sector action, Federal research responsibilities, technology transfer mechanisms, Federal efforts to support engineering education, the development of standards to facilitate integration of diverse components of automation systems. I will briefly discuss each of these areas and point out some of the controversy surrounding Federal involvement in each.

Federal financial incentives are aimed primarily at stimulating research, development, and capital investment. Two relatively new Federal actions are the Economic Recovery Act of 1981 and DOD's capital investment incentives. The Economic Recovery Act provides for more rapid depreciation of new investments in plant and equipment and increases the size of investment tax credits. DOD's capital investment initiatives encourage modernization of the defense industrial base by: Increasing program stability and use of multiyear procurement; supporting legislative efforts to revise tax and profit policies; improving contract incentives; and increasing direct investment in technology for the private sector.

Neither of these actions were taken specifically to foster automation and improve productivity. However, because they may accelerate private sector adoption of automation technologies, both play an important role in encouraging automation. The effects of these actions on private sector capital investment and automation have not been determined.

The second area of Federal involvement is support of automation related R&D both within and outside the Federal Government. Agencies involved in automation-related R&D included NASA, DOD, Commerce, and the National Science Foundation, among others. For example:

NASA's Integrated Programs for Aerospace Vehicle Design, which showed that dramatic increases in engineering productivity were feasible by automating routine information handling tasks.

Air Force's Integrated Computer Automated Manufacturing program, which is encouraging and demonstrating research for an aerospace "factory of the future."

Commerce's effort to establish an inhouse automated manufacturing research facility, which should facilitate development of industrywide standards.

While other programs could be described, most are mission oriented and are affected by disagreement over the extent to which Government should set priorities and support research in automation. For example, at the same time the Air Force is increasing its funding of research in integrating systems, NASA is reducing its software development program which the Air Force planned to use. In the words of one NASA official, "what is missing is a comprehensive, integrated strategy to address the technology. No one is looking beyond individual needs to develop a strategy to improve automation systems."

Another area of involvement encompasses Federal efforts to transfer the technology results of R&D programs. The Congress has shown its support for technology transfer by enacting laws to require it, such as the Technology Innovation Act of 1980, often referred to as the Stevenson-Wydler Act. However, overall Federal support for technology transfer has been inconsistent. On the one hand, the Department of Defense is increasing funding for its "active" technology transfer program, which "pushes" the technology into industry. On the other hand, most civil agency transfer programs have been reduced or reshaped to emphasize "passive" transfer, which requires industry to "pull" the technology to it. This situation is an outgrowth of the different philosophies that have evolved in Federal agencies on technology transfer.

In addition, Government transfer programs tend to serve agency missions and therefore are not systematically coordinated. This results from the absence of a deliberate Federal effort to move the technology from point to point in its development and commercialization or to coordinate transfer programs.

Another area is the Federal Government's support of engineering education and facilities. There is currently a serious shortage of engineers trained to implement automation. Increased enrollment at engineering schools in this country indicates that the problem will correct itself, provided the schools are able to admit and adequately train students. But many believe that without assistance universities will be unable to retain the faculty, purchase the equipment, and develop the new curricula necessary to handle the student increases. While Federal programs supporting engineering education exist in several agencies, comparatively little Federal funding is directed toward improving the state of engineering schools. Rather, most support provides financial aid to increase the supply of engineers.

Finally, if the Federal Government wishes to accelerate the adoption of advanced automation in industry, the National Bureau of Standards can help overcome a major barrier—the lack of standards for integrating components of the technology. Industry standards provide users with flexibility in building automated systems and increase user confidence in quality, which in turn, foster automation's adoption. However, the development of standards for advanced automation technology has been slow. Government has not unilaterally set these standards but has worked with industry to voluntarily build a consensus on the standards that industry should adopt.

The other major category of the Government's involvement in the automation of private industry is the potential impact of automation on the work force. This area is characterized by controversy over the appropriate roles in addressing labor displacement, skills training and retraining, and potential friction between labor and management.

Current Federal programs are not aimed specifically at resolving these issues. The unemployed compensation insurance program, for example, is aimed at general unemployment and was not intended to provide for training and retraining. The Comprehensive Employment Training Act (CETA) is aimed primarily at the chronically unemployed and disadvantaged and, while it has the potential for addressing training in technical skills needed in an automated environment, the programs have not emphasized this area of training. Trade adjustment assistance was aimed at displacements resulting from increased imports and includes training and retraining of workers displaced due to imports. Training of workers displaced by automation, however, is not included as part of trade adjustment assistance.

The Department of Labor has acted as a catalyst in facilitating communication between labor and management but only intermittently and on an industry-by-industry basis. For example, to foster cooperation the Department has sponsored tripartite committees for the construction, steel, and airline industries. These committees, however, were not established or utilized to address automation issues.

Information on displacement, job movement, and skills shifts is vital. So far, however, the Department of Labor has made limited progress in analyzing the potential impact of automation. Labor analysts are projecting continued growth for certain

occupations being afected by automation, although they believe automation may slow that growth somewhat.

Federal support for education and vocational training has declined, leaving unanswered questions as to which sectors of the economy should be responsible for the training and retraining of new technical skills, as well as for education programs in engineering, computer sciences, and other disciplines for which industry officials say a bottleneck to automation already exists.

### THE NEED FOR AN OVERALL PLAN TO GUIDE FEDERAL POLICIES AND PROGRAMS RELATING TO AUTOMATION

Federal policies that affect productivity are often criticized as being ad hoc and not coordinated. This criticism is predictable, given the myriad issues involved, the fact that all of them are interrelated, but that the rules and policymaking responsibilities to address them are dispersed among numerous congressional committees and subcommittees, as well as various Federal agencies. Within this context, maintaining a proper balance in National policies is extremely difficult.

The issues surrounding automation technology, for example demostrate the interrelatedness of polices, rules and Federal programs. We believe these issues demonstrate the need for a planned strategy or framework within which the dispersed rules and policymaking responsibilities can be carried out in a more structured or systematic way.

Automation, for example, demonstrates the need to balance policies to both overcome technological barriers and address social and employment issues. To gain the balance needed, many questions are involved. on the technology side:

Will existing tax incentives foster automation and stimulate productivity at all levels of the economy?

Will capital investment incentives, such as DOD's manufacturing technology program, accelerate private sector adoption of advanced manufacturing technology?

Are there areas of research needed to support accelerated automation which the private sector cannot be expected to?

And if so, will Government-sponsored technology be used by the private sector?

Can universities provide the engineering and other disciplines necessary for growth in automation?

Is standardization of automation technology proceeding at an acceptable pace?

On the employment side can we:

Balance the demand for new skills with those displaced by automation?

Obtain and dissiminate current and accurate information about occupations being affected or likely to be affected by automation?

Facilitate labor-management cooperation for smooth transition to further automation?

Overcome such human barriers to shifting careers as age, mobility, and financial considerations?

Prepare for the possibility of long-term, permanent unemployment?

These and many other questions need to be addressed in examining existing and future policies and programs relating to automation.

What is vital, we believe, is an overall plan and strategy in the Federal Government that, as a minimum, would assure (1) coordination of Federal policies and programs, (2) a means of evaluating their impact, (3) the collection, analysis, and dissemination of comprehensive and specific information about automation and jobs, (4) a mechanism for continuing dialogue among effected sectors, and (5) the assignment of responsibility to see that necessary actions are carried out.

We are aware of numerous legislative proposals to address training, retraining, relocation of workers, and various technological and financial barriers to automation. Because most of the issues involved in automation are interrelated, the Congress will need to explore with industry, lobor, academia, and executive departments and agencies ways to develop a national approach to automation.

In previous reports and in congressional testimony, GAO has expressed the need for a Federal focal point to guide and coordinate Federal programs aimed at improving national productivity and to work closely with the private sector to deveolp a productivity plan. Such a plan would recognize automation as an important variable in national productivity growth. Our work in automation further reinforces the need for a productivity plan that would: Identify and describe the relationship and effect of Federal policies and programs on private sector productivity; delineate clearly the responsibilities of Federal department and agencies having program responsibilities within the plan; identify unnecessary obstacles to productivity improvement created by the Federal Government; develop alternative policies, pro-

grams, activities, and lines of responsibility to improve private sector productivity; and list short-and long-range objectives and their priorities and recommend specific projects and programs within those objectives and priorities.

We believe the issues surrounding automation technology demonstrate the complexities of balancing national policies and priorities. Yet, technology, as complex as it is, is only one part of the total productivity picture of the Nation. For these reasons, we believe it is essential to develop an overall plan or framework within which relevant policies, rules and programs are considered.

This concludes my statement, Mr. Chairman. I will be happy to respond to your questions.

Mr. MILLER. Thank you.

Let me ask, if you might expand on the question with respect to the speed at which we can expect automation to take place.

I ask that in the context of your statement in which you cite that in 1964 Congress established a National Commission on Technology, Automation, and Economic Progress, and in 1966 there was a conclusion that severe unemployment would not result, and in fact it did not.

That generation of computers and technology is far more primitive than what we are talking about now in relationship to cost, speed, size, availability, the ability of individuals to understand and to work with it, and I just wonder if you could expand on what that portends.

Mr. USILANER. We see two forces at work pushing against each other.

One, obviously the stimulators of improving our economy, our productivity, being more competitive in worldwide markets, are pushing the proliferation of automation technology.

We also have some dampening effects on that growth. Those are the barriers that I mentioned in my statement.

It is hard to measure what the impact of those barriers are on the stimulators, but it is certainly having an impact in comparison to other countries.

Mr. MILLER. In looking at it, in doing the study, is there any attempt, and I don't mean an exact attempt but again, to assess the timeframe, because later in the testimony we will hear testimony from people who have very serious and immediate problems with the speed of automation and the manner of implementation, and the timeframe in which Congress has to respond. And my concern is that while you suggest barriers, that of managers, that of people who don't like technology, you also have the economic forces and if you were to assign values to those, the question is, is one simply going to swamp the other?

Are you going to participate or go look for a job elsewhere?

Does an industry find automation as an absolute necessity in terms of its competition in the marketplace or to drop out of the marketplace, those kinds of considerations.

Mr. FRITTS. In the early 1960's when the computer provided a new way of handling massive amounts of information, storing it, retrieving it, and managing it, the benefits were very obvious to the potential users, whether they were insurance companies, banks, or companies whose daily inventory and accounting transactions numbered in thousands.

The advent of tying computers directly into the manufacturing process has made it much more practical now to consider manufac-

turing by use of integrated systems. This presents a vastly different situation.

The potential benefits I think unquestionably are there. The costs versus the payback periods may take quite some time.

That suggests two things: No. 1, companies that are in a fairly strong market position may continue not to go heavily into automation because they are not being threatened, or if they are planning ahead they may decide to go into automation to insure their market position. But the other force, as you mentioned, the competitive forces now, means that those companies whose products are being taken over or markets penetrated by foreign competition, may decide that they have no choice but to automate in order to survive.

The pros and cons are the disparate forces which says we ought to automate, and yet we are going to have problems. For example, the speed with which this occurs is not likely to be at a monumental rate, because we don't have the people who can design these systems or the people to run them. There is still considerable resistance within the management ranks of companies who are the potential users. There still are problems of compatibility of tying the best pieces of an integrated system together. In this regard, developing compatibility standards is pretty much yet to be done.

A long way of answering your question is that I personally would not look for massive displacement in the short run. It would be somewhat gradual but, as we say in the testimony, the faster the barriers are overcome, all of them, the financial, human and so forth, the faster we would expect technology or the CFR adoption of technology to grow. It is therefore critical that, as a nation, we have in place the necessary programs to train, retrain, and relocate displaced workers.

Mr. MILLER. I would like to leave this question for other witnesses. I would put it in the framework of the U.S. Congress, it would seem to me that you now have in progress a generation that is growing up that in 10 years' time will be far more familiar, far more understanding of the technology, of its potential, of its possibilities.

I think the situation with respect to software is far different today than it was 3 or 4 years ago in terms of people and the market for that software. Yet I find that Congress, when dealing with the questions of displacement or implementation, tends to go at these things in 3-, 5-, and 10-year periods. We may in fact find out that even these policy considerations are misguided, to put it in a pleasant term, by the time they are to be implemented.

Mr. FRITTS. I think you are exactly right.

The reason that we have been supporting the idea of developing an overall structure, an overall plan is to give both the Congress and Federal agencies involved in the decisionmaking and policymaking process somewhat of a road map that begins to show the interrelationships of the various policies and programs, and how they affect different sectors. The advantage of a hearing like this today is to ferret out some of these kinds of questions, and particularly getting inputs from those sectors of our economy that are expected to be affected by automation.

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So the answer is not really clear in anybody's mind, but it requires a continuous dialog so that we are at least on the leading edge of what is happening and not reacting to something that has already happened.

Mr. MILLER. In your report, in chapter 3, Department of Labor "Forecast of Increased Jobs, Impacts on Automation," there is a determination that the Department of Labor has decided that the number of jobs in the United States will increase by as much as 31 percent, and some discussion of short-term displacement.

You also state there that although the econometric model does not contain specific data or information to measure the impact on employment, BLS arrives at certain conclusions. Are you comfortable with the validity of those conclusions?

Mr. CHICK. First of all, the projections made by the BLS make an assumption of a 4- to 6-percent unemployment rate, and therefore the projected number of increased jobs are basically skewed to the 4- to 6-percent rate.

The comments made by the Bureau of Labor Statistics about automation and job availability are general. They do not tie specifically the number of jobs affected by automation. However, they do apply limited resources to evaluating to some extent existing technology and the potential effect of that technology on job availability, and they publish this information in the Occupational Outlook Handbook. However, they do not get specific in terms of how automation, in terms of numbers, are going to affect jobs.

Mr. MILLER. Let me ask you if, in your opinion, that information is sufficient for the Congress in making these kinds of determinations or understanding them?

Mr. CHICK. No sir, in my opinion, they do not apply sufficient resources nor do they collect the type of data needed to make a determination of the direct impact. It is only a generic determination for the most part.

Mr. MILLER. So within the specific occupations, they list how many occupations?

Mr. CHICK. 273.

Mr. MILLER. Within the specific categories, they really can't tell us a great deal?

Mr. CHICK. They can tell us that automation slows the growth but they do not get any more specific than that in terms of how much it may slow the growth of an occupation. Certain occupations are recognized as being hard hit; postal workers, typesetters, occupations such as that, and the Bureau of Labor Statistics is a little bit more specific in terms of the automation impact there.

However, the unemployment issue is very complex and there are many factors that affect unemployment levels but this particular factor, automation, is not quantified.

Mr. MILLER. I was very uncomfortable reading the report, and I don't want to attribute statements to GAO, but in reading their various analyses of occupations and job groups and at the same time constantly through that, it was suggested they really have not applied the kind of information that is available to making these kinds of determinations.

Mr. CHICK. Good information is not available anywhere at this time. Even studies performed by private organizations have often

cited the lack of information on this subject matter, and it is apparent that the information is not being obtained at this point. There is a question as to the obtainability.

Mr. MILLER. From the occupational handbook of 1982 to 1983, they are going to have, in fact, even more difficulty.

Mr. CHICK. That is correct.

Mr. MILLER. Your final statement suggests that a number of occupations are going to be dropped.

Mr. CHICK. Yes. Much of the industry data will be eliminated also.

Mr. MILLER. Would that be contrary to our efforts to try to get a handle on what to expect?

Mr. CHICK. It is very important to provide information to both Government and to the public in terms of what jobs will be available in the future and cutbacks in this effort will certainly have an effect on how much information we can provide for this purpose.

Mr. MILLER. In going through the BLS information, what is it in their informational base that leads to their conclusions, which are contrary to the conclusions which have been suggested by you on—you just happen to cite the British Broadcasting System or World Watch, which has always been on the down side of the issue. What is it in their informational base that leads them to assume 4 to 6 percent unemployment; are they in a position to say that?

Mr. CHICK. The BLS assumption is made based on one of the arguments; that is that unemployment will decrease because of automation.

They believe new jobs will be created by an expanding economy as well as obtaining a market share recovery in addition to the new jobs created by automation itself.

Based on those factors, they assume that the unemployment rate would be 4 to 6 percent, and the projections they make show this assumption, so many of the ocupations that BLS indicates are going to be affected by automation are still expected to grow based on the assumption.

The projections made are not necessarily correct, and I believe BLS would agree to that, and there are a lot of assumptions made in their model.

The usefulness of the information they had for our study involved which occupations would be affected, but not the projections—we could not place reliance on whether those occupations will really grow or not in the future.

Mr. USILANER. I think this one example underscores one of the major themes of the message that we want to get across today, that is the piecemeal approach to policymaking—the cutback in the type of information which we feel is vital to making decisions that will help our economic competitiveness.

You have other programs that are pushing technology and certain programs that are being cut back on technology in the Federal Government. This is the piecemeal uncoordinated approach that we have been taking on problems such as productivity and automation.

Mr. MILLER. We have pretty well discussed this—I am not comfortable. I guess what I am suggesting is, I don't think Congress should rest on that prediction of the future impacts.

It seems to me to be rather sketchy at best, and I assume that in the first part of your report you are simply reporting that as the BLS statements, not as an endorsement or that you consider them to be correct, but simply reporting the projections of one agency that is supposed to deal with changes in jobs and occupations.

Mr. USILANER. We have seen enough disagreement with the Department of Labor's model to make us uncomfortable. No one really knows what the long-term displacement is going to be.

Mr. CHICK. The model is effective in giving the readers an idea of the mix of occupations that would exist, but in terms of the growth of total occupations as well as each one, the projections are basically based on the assumption of the unemployment rate which, when compared to the availability of people to hold jobs, give you an end result which, in my opinion, is basically a forced end result.

Mr. MILLER. In the next chapter, Federal, State, and local government assistance, in reading that over the weekend my note to myself is that in fact there is basically none in terms of individuals who are displaced short term or long term, there is basically little or no assistance?

Mr. CHICK. The assistance provided to those people is the same as to the general population of the unemployed.

The factors such as unemployment insurance, CETA, welfare, unemployment service system, are available to the general public and for the most part, there is no special consideration at this time to the person displaced by automation.

Mr. MILLER. The point that this assistance is no different than that allowed to the general public who finds itself unemployed is exactly the problem. If I read correctly your analysis of the various systems that are in place, you are in some instances talking about a skilled worker who comes off a highly paid job, who has been told that his moving expenses will be paid to Houston, although he may not necessarily be trained to go to work when he or she arrives, and the CETA program is not applicable in most instances to these people because the job training is for an entry level position.

The only thing we are talking about is the duration of financial underpinning to the unemployment insurance. We are not talking about sophisticated training mechanisms provided by any level of govenrment for the skilled worker who is displaced.

Mr. CHICK. Yes, sir, as you know, the specific target of CETA is the chronically unemployed and disadvantaged and one of the points made in this study is that in addition to the low-paid manual jobs, automation can also affect higher-paid and higher-skilled people. That is a valid observation, sir.

Mr. MILLER. I think your report is very enlightening. I am afraid it sketches a very involvement, and that may cheer some people, but a superficial involvement in this issue, which some of my colleagues feel is the most important issue facing this economy and this country. I am led to believe the efforts of the agency responsible for telling the Government of trends in the job marketplace are inadequate as to what they have done to date, and are going to be more inadequate in the future in terms of specifically detailing it to us. And that problem is shared in the private sector, and in fact there is no mechanism in place for dealing, even for what they recognize will be the short-term displacement.

Mr. CHICK. The study that we performed was not intended to be an evaluative study. Much opinion does coincide with your view and we wanted to put that opinion into the staff study.

Mr. MILLER. As you review the component parts that are in place, either for predicting it or trying to assess future trends, or dealing with the current problems, it is pretty dismal, a pretty dismal set of components for which to deal with this issue. And the other part of it that concerns me, whether this is your opinion or not I want you to comment, is that there seems to be some suggestion that the competency and the degree of advancement of automation in the workplace or in the economy is going to progress along about at the same timetable that it has in the past.

And I would be very concerned, and I expect others to comment on this later, if that is accepted, that I recognize the traditional barriers, but when I came to Congress there were 25 bills in the Congress, to prohibit scanners at the checkout stand at Safeway. Today, I don't know of a Member of Congress who would introduce that bill.

I am very concerned that the acceptance is perhaps faster than the governmental recognition of that acceptance of the technology.

Mr. USILANER. You had asked before about the barriers. There was an article last week in Business Week called "Concessionaire Bargaining," and it was the feature article that has shown how labor-management cooperation has changed significantly, a more cooperative mode, labor more willing to get rid of restrictive work rules, more willing to work with management in not restricting job titles.

What we are seeing is a change in the atmosphere, at least we have picked this up in meetings, and in this type of reporting shows much less resistance, probably because of the critical state of our economy. There appears to be much less resistance than we had seen in the past.

Mr. MILLER. You are going to have to excuse me. I have to go vote.

We have a couple of questions if you wouldn't mind responding.

Mr. HOULIHAN. Can you give us an example of higher skilled and higher paid occupations that are being affected by automation.

Mr. CHICK. Yes, potential displacement of people in occupations such as middle management, credit managers, typesetters, buyers, and other occupations are possible and in some cases we are experiencing it now. The staff study cites examples of higher paid and/or higher skilled people affected.

Mr. HOULIHAN. Most of the discussion has been in the manufacturing area and today we are trying to look at some of the office areas, but I have also read quite a bit about the effect on middle management.

Explain how automation might affect middle managers.

Mr. CHICK. Yes. Several years ago I did a study on what at the time was called automated decisionmaking in which you can program a computer with established criteria to analyze data and make decisions and initiate action without manual reviews.

Currently, a step above that, artificial intelligence is being worked on which allows the computer to do more than just follow a

program, and what it does can fit some definitions of actually thinking and learning.

When you have situations like this and you have a manager that makes basic decisions based on existing criteria, you can possibly replace a manager by having a computer do it much faster.

In addition to that, computers are capable of doing many administrative functions currently done by management.

Mr. USILANER. That is true in the office environment as well. Office technology has placed the information flow at a greater rate and questions whether that information has to flow from bottom to top through a middle management level. A lot of corporations are questioning that level now in terms of their cutback.

Mr. HOULIHAN. I would like to ask a question that the chairman mentioned with the BLS work.

We talked about the occupational handbook, but there is another division of the Department that has been systematically looking at that technological change.

Could you give us an idea of what the Department of Labor's efforts are in that area?

Mr. CHICK. You refer to the Office for Productivity and Technology Studies, they do perform analysis of selected industries. They select about 40 industries and do a study on about 4 a year, which indicates they study 1 industry every 10 years.

This problem—in my opinion it is a problem—because the data does get old. This problem is directly related not to the quality of work they do but rather to the resources they have to do that work.

Mr. HOULIHAN. When you look at the Department of Labor, the division that does the handbook and the productivity division, are there other divisions which contributed to the occupational projections?

Mr. CHICK. The data feeds into the people that have the model from various sources.

Other sources include data obtained in household surveys from employees, as well as employment data obtained from employers.

This data is put together for the purpose of making projections of occupational mix as well as providing data in the occupational handbook.

Mr. HOULIHAN. That is all the questions I have.

Mr. USILANER. Thank you.

Mr. HOULIHAN. Thank you very much for coming.

[Recess.]

Mr. MILLER. The next witness that the subcommittee will hear from will be Mr. Dennis Chamot, who is the assistant director of the Department for Professional Employees, AFL-CIO.

Please proceed in the manner you feel most comfortable, and also, if you wish to comment on anything you have heard before, feel free to do so.

### STATEMENT OF DENNIS CHAMOT, ASSISTANT DIRECTOR, DEPARTMENT FOR PROFESSIONAL EMPLOYEES, AFL-CIO

Mr. CHAMOT. I appreciate the opportunity to do that.

You are facing one of the most important issues, not only to American workers but to the entire American economy.

Mr. MILLER. They still can't hear you.

Mr. CHAMOT. I will quickly read through my statement and I will be happy to respond to whatever questions the committee might have.

I would like to begin by mentioning how we got into this issue.

The department of which I am assistant director, the Professional Employees Department of the AFL-CIO, has 27 affiliated unions which represent a wide diversity of people employed in virtually every major professional field.

We got into the issue primarily because of the effects of some of this new technology on one particular group of employees, and that was drafters.

They were being subject to some developing technology which would take engineering information, run it through a computer and turn them into final drawings of very high quality. The potential was there for eliminating the jobs of these drafters. The union that represented them started studying it.

We found that similar kinds of things were happening across the board.

I wish to point out that the problems developed in a white-collar, highly technical, highly skilled area and that technological change affects those areas as much as any other.

While other witnesses who appear before you today will mention specific problems, I would like to discuss some broad issues which cause us concern. It was not that long ago, in historical terms, that the United States was primarily an agricultural nation. A hundred years ago, 51 percent of our work force were agricultural workers. As farming technology improved, productivity rose, and large numbers of people moved from the farms to the cities, looking for work. A lot of them, and millions of immigrants too, found jobs in the growing factories.

I won't comment here on the abysmal conditions in many of these factories, but I just note that a lot of people worked in them, many coming off the farms. Indeed, farm technology has improved to the point where today less than 3 percent of our work force are agricultural workers. In absolute terms, we now have only one-third the number of farmworkers as we did 100 years ago, even though the population has increased manyfold.

The factories have not been stagnant. What with all of our current concerns, today's factories are enormously more productive than those of the past. They need to employ far fewer people than would have been necessary if we never advanced beyond 19th-century technology. Where did everyone go? For the last few decades, much of the employment growth has been in the service sector, including government. Today over 50 percent of the American work force is white-collar.

Today governments at all levels, as well as private companies, are under financial pressure. All want to improve productivity, and most are approaching the problem with the traditional view that higher productivity means more machines and fewer people. Where are the displaced people to turn?

We recognize the need to improve productivity, but how are the fruits of the improvements going to be used?

In the past, some of the savings led to new investment in growth areas, but we are not growing very rapidly now and, furthermore, we have run out of sectors. We can talk about increased leisure time, continuing a long historical trend toward fewer hours in the work day, shorter work weeks, increased vacations, and the like, but would this only apply to those fortunate enough to retain their jobs in high productivity industries?

We could find ourselves developing a new class structure, based upon the level of technology in any particular industry, with the elite few having far more benefits than the mass of the population. On the other hand, we could talk about greatly expanding the public sector to provide socially useful and needed services. Or we could speculate endlessly about increasing concentrations of wealth, and so on. But the future is not preordained, it depends very much on what we decide to do today. In any case, it is certain that modern technologies will have major effects.

We are not just talking about robots. Today's technologies are very sophisticated and take many forms. They include computer-integrated manufacturing centers, automatic warehouses, word processors and desk-top computers, automatic teller machines and computerized checkout counters, satellite communications systems, even direct computer-to-computer links. Many of these systems are designed to eliminate human activities, so we should not be surprised that the work they do can be performed by fewer people.

We are now suffering through the highest rate of unemployment since World War II. Most of that is undoubtedly because of the poor state of the economy. It would be difficult, if not impossible, to get an accurate count of jobs lost to automation in the face of the overwhelming loss of jobs created by poor economic decisionmaking. Further, it has been argued that past technological developments led, in the long run, to the creation of more jobs than were lost. Wouldn't the same hold true in the future?

We think not, and that is partly because of the nature of the technology itself. The big difference is the computer, and the development of the computer on a chip. It is now possible to give machines the flexibility and decisionmaking ability that heretofore could only be obtained from human workers. The enormous capacity and speed of computers makes many things possible which couldn't have been imagined only a few years ago.

Manufacturing technology is already highly automated in many industries. With further developments in computer vision and tactile sensing, a good deal of assembly work may be automated. The same is true of materials handling. It is conceivable that blue collar workers in manufacturing could eventually become as rare as farm workers.

Even within manufacturing, much of the employment growth has involved white-collar jobs; secretaries, accountants, engineers, computer programers, lawyers, advertising personnel, and so on. Computer technology will affect them all, too. The total is the sum of the parts. If every company, every government agency, seeks to improve productivity and control personnel costs through new technology, the result may well be a growing GNP coupled with high

unemployment. If we emphasize modernization through investment in the latest technology even while we have more than 10 million unemployed, and ignore the human impacts, the social costs may be immense. New technology will lead to near-term, localized problems, at least. What the more distant future holds in store is anybody's guess.

Our Government has all but ignored these issues for quite some time. The same cannot be said of other countries. Many are concerned enough to try to deal with the short-term problems.

The Swedes, for example, have developed an extensive, government-funded training program for the structurally unemployed. About 1 percent of the total work force is involved in this program. A couple of years ago, double that number were involved. One reason for its success is that participants receive a stipend which is set higher than unemployment compensation. Coupled with a very extensive public works program—about 1½ percent of the workforce—these activities helped Sweden achieve an unemployment rate of about 2 percent, less than one-quarter that of the United States. It should be noted that while these programs do not produce permanent jobs, they do help individuals displaced by technological change, as well as others, lead productive lives.

The Swedish Government has also established numerous commissions to study the potential problems arising from technological changes, and to recommend social action where warranted. These commissions routinely include labor and management members.

In Germany, state and local governments work cooperatively with industrial unions and employers to develop programs for labor markets which are hurt by technological changes. These programs include not only tax incentives to attract new businesses into the affected communities, but also training and retraining programs for the people directly affected.

The German Government has long been committed to keeping its industrial base among the most modern in the world. The federal Ministry of Research and Technology has a budget of over $6 billion. It is used for promoting new technologies, and at the same time, also funding studies promoting the humanization of workplaces. That one ministry is responsible for both areas.

In Britain, a country with economic problems as severe as our own, their Department of Employment did a major study, published in 1979, "The Manpower Implications of Microelectronics Technology." While their timeframe was much too short, only 5 years, the study does indicate that the government recognized the importance of these issues. The British Department of Industry began in 1978 the Microelectronics Applications Program [MAP] to promote the use of new technologies in industry. The program provides financial support, money for training programs, and technical advice. The Trades Union Congress, the British labor federation, has received well over $1 million from this program to fund development of their own programs aimed at educating workers about these technical developments.

These are just a few of the ways other countries are reacting to the challenges presented by changing technologies. Further details are contained a report we issued about a year ago "Cooperation or

Conflict. European Experiences with Technological Changes at the Workplace," a copy of which I am submitting with this statement.

Why has there been more concern for problems associated with technological changes in other countries than in the United States? The American approach seems to have involved a great deal of faith in technology itself, in the belief that if we only could develop more and more sophisticated systems, productivity would zoom and all of our problems would evaporate. Things have not worked out that way, and our European brethren have been less willing to simply let things drift. Their governments have been far more willing to help not only business, but also affected workers and communities. In many cases there has been a higher degree of cooperation among the business community, labor unions, and government in planning and implementing programs.

Now, nowhere in my statement have I indicated that the American labor movement is opposed to technological change.

There as an interesting study by Doris McLaughlin, I believe at Wayne State and the University of Michigan, called, "The Impact of Labor Unions on the Rate and Direction of Technological Innovation." Her conclusion was that unions indeed are not the prime factor in restricting the development of new technologies, that most unions will willingly go along with changes that are suggested.

Those that oppose the changes usually do so because there is some immediate threat to the welfare of their members, and if those immediate threats are taken care of, they too accede to the changes.

In spite of all the problems, we recognize that change is a necessary constant in our lives. But we are concerned as much with how particular changes are brought about as with the details themselves. No matter what the long-term effects will be, it is a certainty that there will be short-term problems.

In evaluating the contrasting claims of technology optimists and pessimists, I believe it is important to look at the areas they are emphasizng. For example, in manufacturing, new technology which results in the development of new products may well lead to the creation of new jobs, even if output expands. Similarly, in services, replacement of workers by computers and telecommunications systems can reduce employment in the industry, or at least limit growth, even with rising output. In other words, if productivity rises faster than output, employment will drop.

Does this mean that we should oppose productivity improvement? Not at all, but it does indicate that we need to be aware of the problems, and we have to plan to meet them.

We are in the midst of a revolution that will leave virtually no form of work unchanged. The application of computer and microchip technology, coupled with the range and flexibility of telecommunications systems and other devices and materials, offer a potential for change which is truly profound. We are reducing the demand for blue collar workers, as has already occurred for farm workers; we are reducing skill requirements for some crafts, for example, typesetting and machine tool operation, through the use of computers; we are eliminating service jobs previously done by people—for example, computer-aided design for engineers; we are

reorganizing and capitalizing office work; we are automating warehouses and retail checkout counters; I have even heard that the fast food industry is considering using robots to prepare and serve food.

If all of this is going on during a serious recession, the pace of change must quicken when recovery finally arrives. This could mean that unemployment will not drop as far as otherwise would be the case. It certainly means there will be a great need for training and retraining programs, for protection of salaries and benefits as people are shifted into new positions, for real improvements in the quality of working life, rather than having the machines dominate the work environment. Above all, it will require joint action on the part of all affected parties: government, business, labor, and the community. We have a long way to go, and the later we begin, the more difficult the problems will become.

[Prepared statement of Dennis Chamot follows:]

PREPARED STATEMENT OF DENNIS CHAMOT, ASSISTANT DIRECTOR, DEPARTMENT FOR PROFESSIONAL EMPLOYEES, AFL–CIO

My name is Dennis Chamot. I am Assistant Director of the Department for Professional Employees (DPE) of the AFL–CIO. The AFL–CIO is a familiar organization to this Committee, but I would like to take a moment to describe the DPE, and to explain how we became interested in technological change.

The Department is made up of 27 national and international AFL–CIO unions (list attached) which represent approximately two million individuals employed in virtually every major professional field. Among them are performing artists—musicians, actors, singers and dancers—and associated technical crafts. Also represented are nurses, pharmacists, laboratory technologies and other health care personnel; teachers and college professors; scientists and engineers; librarians, social workers, etc.

Several years ago, drafters represented by one of our affiliates began to encounter some problems related to the introduction of computerized equipment which was capable of producing drawings from the information provided by engineers. The potential was there, at least as the technology improved, for elimination of drafter's jobs. As we looked into these issues further, we found that similar developments were occuring in many different areas. My point, though, is that we began to study this issue because of the impact on white collar jobs, even before the concern about industrial robots had reached the level of visibility it currently enjoys.

While other witnesses who appear before you today will mention specific problems, I would like to discuss some broad issues which cause us concern. It was not that long ago, in historical terms, that the United States was primarily an agricultural nation. A hundred years ago, 51 percent of our workforce were agriculture workers. As farming technology improved, productivity rose, and large numbers of people moved from the farms to the cities, looking for work. A lot of them, and millions of immigrants, too, found jobs in the growing factories. I won't comment here on the abysmal conditions in many of these factories, but I just note that a lot of people worked in them many coming off the farms. Indeed, farm technology has improved to the point where today, less than three percent of our workforce are agricultural workers. In absolute terms, we now have only one third the number of farm workers as we did 100 years ago, even though the population has increased many fold.

The factories have not been stagnant. What with all of our current concerns, today's factories are enormously more productive than those of the past. They need to employ far fewer people than would have been necessary if we never advanced beyond nineteenth century technology. Where did everyone go? For the last few decades, much of the employment growth has been in the service sector, including government. Today, over 50 percent of the American workforce is white collar.

Today, governments at all levels, as well as private companies, are under financial pressure. All want to improve productivity, and most are approaching the problem with the traditional view that higher productivity means more machines and fewer people. Where are the displaced people to turn?

We recognize the need to improve productivity, but how are the fruits of the improvements going to be used? In the past, some of the savings led to new investment in growth areas, but we are not growing very rapidly now, and furthermore, we have run out of sectors. We can talk about increased leisure time, continuing a long historical trend toward fewer hours in the work day, shorter work weeks, increased vacations and the like, but would this only apply to those fortunate enough to retain their jobs in high productivity industries? We could find ourselves developing a new class structure, based upon the level of technology in any particular industry, with the elite few having far more benefits than the mass of the population. On the other hand, we could talk about greatly expanding the public sector to provide socially useful and needed services. Or we could speculate endlessly about increasing concentrations of wealth, and so on. But the future is not preordained; it depends very much on what we decide to do today. In any case, it is certain that modern technologies will have major effects.

We are not just talking about robots. Today's technologies are very sophisticated and take many forms. They include computer integrated manufacturing centers; automatic warehouses; word processors and desk top computers; automatic teller machines and computerized check-out counters; satellite communications systems; even direct computer to computer links. Many of these systems are designed to eliminate human activities, so we should not be surprised that the work they do can be performed by fewer people.

We are now suffering through the highest rate of unemployment since World War II. Most of that is undoubtedly because of the poor state of the economy. It would be difficult, if not impossible, to get an accurate count of jobs lost to automation in the face of the overwhelming loss of jobs created by poor economic decision making. Further, it has been argued that past technological developments led, in the long run, to the creation of more jobs than were lost. Wouldn't the same hold true in the future?

We think not, and that is partly because of the nature of the technology, itself, The big difference is the computer, and the development of the computer on a chip. It is now possible to give machines the flexibility and decision making ability that heretofore could only be obtained from human workers. The enormous capacity and speed of computers make many things possible which couldn't have been imagined only a few years ago.

Manufacturing technology is already highly automated in many industries. With further developments in computer vision and tactile sensing, a good deal of assembly work may be automated. The same is true of materials handling. It is conceivable that blue collar workers in manufacturing could eventually become as rare as farm workers.

Even within manufacturing, much of the employment growth has involved white collar jobs—secretaries, accountants, engineers, computer programmers, lawyers, advertising personnel, and so on. Computer technology will affect them all, too. The total is the sum of the parts. If every company, every government agency, seeks to improve productivity and control personnel costs through new technology, the result may well be a growing GNP coupled with high unemployment. If we emphasize "modernization" through investment in the latest technology even while we have more than ten million unemployed, and ignore the human impacts, the social costs may be immense. New technology will lead to near term, localized problems, at least. What the more distant future holds in store is anybody's guess.

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For example, in manufacturing, new technology which results in the development of new products may well lead to the creation of new jobs. On the other hand, technologies which improve the productivity of processes involved in the manufacture of existing products may lead to a net reduction in jobs, even if output expands. Similarly, in services, replacement of workers by computers and telecommunications systems can reduce employment in the industry, or at least limit growth, even with rising output. In other words, if productivity rises faster than output, employment will drop.

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people are shifted into new positions, for real improvements in the quality of working life rather than having the machines dominate the work environment. Above all, it will require joint action on the part of all affected parties—government, business, labor and the community. We have a long way to go, and the later we begin, the more difficult the problems will become.

AFFILIATES OF THE DEPARTMENT FOR PROFESSIONAL EMPLOYEES

Actors Equity Association.
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American Federation of Musicians.
American Federation of State, County and Municipal Employees.
American Federation of Teachers.
American Federation of Television and Radio Artists.
American Guild of Musical Artists.
Association of Theatrical Press Agents and Managers.
Brotherhood of Railway and Airline Clerks.
Communications Workers of America.
Federation of Professional Athletes.
Insurance Workers International Union.
International Alliance of Theatrical Stage Employes and Moving Picture Machine Operators.
International Association of Machinists.
International Brotherhood of Electrical Workers.
International Federation of Professional and Technical Engineers.
International Union of Electrical, Radio and Machine Workers.
International Union of Operating Engineers.
National Association of Broadcast Employees and Technicians.
Office and Professional Employees International Union.
Retail, Wholesale and Department Store Union.
Screen Actors Guild.
Seafarers International Union.
Service Employees International Union.
United Association of Journeymen Plumbers.
United Automobile Workers.
United Food and Commercial Workers.

# COOPERATION OR CONFLICT

## European Experiences with Technological Change at the Workplace

A Publication of the Department for Professional Employees, AFL-CIO

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## European Experiences with Technological Change at the Workplace

BY: Dennis Chamot and Michael D. Dymmel

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# Introduction

"Adapt or die" has always been the rule governing the evolution of life on this planet. The same is true of organizations and professions. In those cases when we are faced with change occuring on a massive scale, and with great rapidity, we often refer to it as revolutionary.

We are today on the verge of a revolution that will leave virtually no form of work unchanged. The application of computer and microchip technologies, coupled with the enormous range and flexibility of developing telecommunications systems, offer a potential for change which may be every bit as profound as that caused by the first Industrial Revolution.

That occurrance, from our modern perspective appearing very rapid, but in reality continuing over many years, transformed much of the Western world from agricultural communities to industrial giants. There is talk now of going beyond the industrial age into the Information Era, when power and wealth will derive more from the generation and manipulation of data than from the fabrication of material goods.

In manufacturing, computers and computer driven equipment are already playing an ever more important role on the factory floor, while white collar "front office" work – information handling – expands enormously. In the service areas, both in private and public enterprises, developments such as minicomputers, word processors, automatic equipment, all linked by extensive telephone and satellite networks, are revamping the very way workplaces are designed and jobs themselves are defined.

Adapting to this revolution presents organized labor with one of its greatest challenges in decades. On the one hand, the new developments are too massive and extensive to even think of trying to stop in their entirety. Besides, many are necessary for improving American productivity at a time when economic growth has been very sluggish. On the other hand, present throughout is unprecedented opportunity for excessive management domination and control, through detailed monitoring of computer systems, as well as a very real possibility of economic growth (business growth) occuring in the face of growing unemployment. Such is the enormous capacity of integrated computer systems, a goal of many businesses here and abroad.

These changes are not limited to the United States. Similar problems are being faced in every major industrial nation. They directly affect professional and technical employees, who find themselves on the frontiers of innovation. On the assumption that we have much to share and learn from one another, and in our continuing efforts to try to understand and deal with problems generated by technological change, we present this report on some of the activities and thoughts of our colleagues in several European countries.

We begin with three long chapters describing in some detail pertinent background from three countries – Sweden, West Germany and the United Kingdom. The material presented here is based in part on the results of discussions between European trade unionists, government officials and management representatives and a delegation from affiliated unions of the Department for Professional Employees, AFL-CIO, headed by Rodney A. Bower, President of the International Federation of Professional and Technical Engineers. These meetings were held in the respective countries during October, 1980 (see Appendix). Also included in this report is a brief description of the technology steward system being developed in Norway. The final chapter, titled "Discussion", presents an analysis of the European situation, and some conclusions and implications relevant to the American scene.

Technological change issues have been growing in importance yearly. We hope that this publication offers useful information about what others are doing, and stimulates further fruitful discussion here in the United States.

I would like to close by offering our grateful thanks to the German Marshall Fund of the United States, who generously supported the European study tour referred to above, as well as the publication of this report.

**Dennis Chamot**
*Assistant Director*
*Department for*
*Professional Employees, AFL-CIO*

March, 1981
Washington, D.C.





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# Sweden

Sweden is a small, fairly homogeneous country. Most of its population of just over 8,000,000 is urban, and concentrated in the southern part of the country. The workforce of about 4,000,000 people is highly literate, and highly skilled.

Sweden's industrial origins can be traced back two to three hundred years, when the first exploitation of its natural resources of copper, iron ore, and lumber took place. Although these origins formed the bases for strong modern industries, the Swedes claim several key inventions propelled their relatively poor, rural society into the midst of the industrialized world of the 20th Century:

- Ball bearings
- Hydraulic separator
- Telephone
- Electronics.

Sweden's international and highly respected automobile manufacturer, Volvo, originated in the ball bearing industry, while the hydraulic separator formed the basis for an extensive machinery industry. Alexander Graham Bell notwithstanding, the telephone was "invented" in Sweden at about the same time as in the United States, leading to the development of an industry as important in Sweden today as it is in the United States. Electronics, in its early forms in communications equipment, rectifiers, and electrical power generation and transmission equipment formed the basis for what is today Sweden's largest and most dynamic industrial sector, engineering (machinery and construction) which currently accounts for roughly one-third of the country's industrial output and one-half of the total value of its exports. Sweden's well-known neutrality during the two World Wars forced the development of their own airplane manufacturing industry, SAAB. Neutrality also allowed Sweden to come through the wars with its industrial base intact and ready to take its place in the post-war industrialized world.

Sweden, however successful in its industrial development, is a world economy and is subject to the vagaries of world economic fluctuations. As a country dependent on exporting to Europe and the rest of the world about 40 percent of industrial production to survive, it cannot limit its imports, which amount to about 40 percent of its needs. As a result, its automobile industry is suffering from an onslaught of Japanese imports. Its heavy machinery industry is under attack by other European countries and the United States. And one of its earliest and most basic industries, lumber and pulp and paper, is facing heavy competition from U.S. and Canadian interests.

The world-wide economic recession generated by the increased prices of Arab oil is responsible for the worst disruptions in Sweden's economy. In maintaining full employment as a government policy, economic decisions were made based on assumptions that the recession would be short-lived. When this did not occur, a three-pronged attack was tried to regain Sweden's position in the world economy – a currency devaluation designed to make exports more competitive, increased taxation through the use of a value added tax, and the severing of connections with the European currency block. Swedish trade unions, as a whole, cooperated by moderating wage demands during these years. As a result, Sweden was able to regain its position in the world economy, recording a trade surplus and a halving of their rate of inflation.

An organized labor movement in Sweden dates to 1846 with the establishment of the Typographical Association in Stockholm. Development was slow, and stifled at almost every turn by employers until 1880 when the first real trade unions formed along craft lines. The formation of the Swedish Trade Union Confederation (LO) and the Social Democratic Party can also be traced to this period. The labor/management relationship reached a more advanced stage in the early 1900's with the formation of the first employer group, SAF, the Swedish Employer's Federation. The government in general left the employees' and employers' associations free to negotiate among themselves, and the two groups gradually came to recognize each other as equal parties at the bargaining table.

Labor laws began to develop in the 1920's. A Collective Contracts Act was passed that set in law the rights and obligations of each party to the other and outlined general provisions relating to working conditions. Also established at this time was a Labor Court to which disputes over collective bargaining agreements were to be taken for resolution before any industrial actions were resorted to. The Labor Court has seen varying amounts of activity since its formation and has developed a large body of precedents. These form very efficient guidelines for labor/management interaction leading to the resolution of many disputes before they advance to the Labor Court itself.

The 1930's saw the first formation of white collar unions in Sweden completely independent of the LO. Where blue collar workers had organized along craft lines some 50 years earlier, white collar unions developed from the extension of professional and social organizations.

Two associations formed by early white collar unions merged in the 1940's to form the Central Organization for Salaried Employees (TCO). One other white collar union association exists in Sweden, the Swedish Confederation of Professional Associations/National Federation of Civil Servants (SACO/SR). This group describes itself as a central professional organization for university graduates and salaried employees with higher education, and draws its membership 50 percent from state government employees, 26 percent from local government employees, 20 percent from private industry employees, and 4 percent from self-employed professionals.

In 1911, the craft unions in the LO voluntarily decided to reorganize themselves along industry lines. The basis for this decision was to avoid interunion competition and jurisdictional problems that could have resulted from several different craft unions representing workers in one industry. There are only a few unions left in Sweden which are organized along craft lines.

Labor legislation saw significant advances during the 44 year rule of the union backed Social Democratic party in Sweden:

- The Vacation Act allows every employee five weeks vacation minimum per year;
- The Act on Working Hours stipulates a 40-hour maximum work week and limits overtime per employee to 150 hours per year;
- The Security of Employment Act greatly limits the ability of employers to fire employees;
- The Promotion of Employment Act requires employers to notify county labor boards of any planned cutbacks involving five or more workers;
- The Shop Stewards Act strengthens the position of union representatives by forbidding discrimination against shop stewards, giving them supersenioriity in layoff situations, and allowing them unlimited leave of absence rights for union activities;
- The Board Representation Act allows workers in firms larger than 25 employees to elect two representatives to the board of directors of the company, with full participation in the decisions of the board; and
- The Joint Regulation of Working Life Act guarantees the union full information about the company, gives the union a right to approve organization of work and work assignments, in addition to hiring and firing of employees, and allows the union to veto subcontracting of work by the employer.

Labor legislation in Sweden is supplemented by a body of social welfare legislation without equal anywhere in the world. For example, childcare is provided free; public education, including school supplies and meals, are free; health care is free with minor exceptions; senior citizens are provided with pensions indexed to the cost of living and housing subsidies; and the handicapped are provided assistance in locating employment while employers are subsidized to hire and train the occupationally disadvantaged.

The welfare state of Sweden is certainly not without its attendant costs. Personal income tax is high, with marginal increases in income taxed near 80 percent. The social costs of alcoholism are paid through extremely heavy levies on alcoholic beverages. The same is true for the health costs of smoking tobacco. Average Swedes, however, look upon their system as the best in the world, and considering the advances made in human welfare in Sweden, they have a lot to be proud of.

## Labor

The Central Organization for Salaried Employees (TCO) and the Swedish Trade Union Confederation (LO) present fairly similar views on the problems facing labor in Sweden today. Their views are similar until the question of technological change is presented. (The Swedish Confederation of Professional Associations/National Federation of Civil Servants (SACO/SR) has had little interest in the issues surrounding technological change.)

The TCO is an umbrella organization that is comprised of 24 affiliated trade unions with a total membership of over one million persons. TCO affiliated unions organize all sectors of white collar employees and at almost all levels. A slight majority of its members are female and TCO can claim some 60 to 70 percent of all organizable salaried workers in Sweden. Since TCO is a decentralized federation, most responsibilities fall to its affiliated unions. Collective bargaining, for example, is a responsibility left to the constituent unions while the TCO functions primarily as a coordinating and informational agency. TCO is also a nonpolitical organization but can and does exert its influence in political circles for the benefit of its membership.

To enhance its influence in collective bargaining, the TCO has formed cartels with other employee federations in the three sectors of the Swedish economy – the private sector, the state sector, and the local government sector. One of these, with the private sector constituent unions of SACO/SR, is the Private Salaried Staffs' Cartel (PTK). These cartels, moreover, bargain with different employer federations in each sector. The net result of the formation of these bargaining cartels is that Swedish employers have had to face a united labor front in most of their collective bargaining.

TCO is becoming increasingly involved with technological change and its effects on workers and worklife. Concern over these effects can be traced to 1970 when, for the first time, information gathered in the Swedish five year census was to be recorded on a computer-based medium. Questions raised at that time dealt with integrity – how the information gathered would be used and how it would be safeguarded from unscrupulous interests – rather than the effects of the medium itself on workers. These concerns resulted in

L. to R. - Dennis Chamot, DPE; Lennart Bodström, President of TCO; and Rodney Bower, IUPE

strict government regulations designed to maintain the privacy of any information gathered and stored in computerized data bases.

During 1975-76, Swedish white collar trade unions began discussions about the effects of computerization specifically on work, jobs, and employment. Accelerating over the last two years, these concerns have been fueled by statistical projections showing increasing unemployment due to the effects of technological change. Some 25 commissions consisting of labor, industry, and government representatives have been formed to conduct investigations of the potential effects.

Until the early 1970's, these trade unions had little interest in influencing policy, given the predominence of Social Democratic rule for the prior 40 years, and the close relationship between that party and the labor movement. The gradual weakening of Social Democratic power in their final years in office led to a resolution at the 1970 TCO Congress that, in the future, "work" should have the same influence as "capital" in the economic marketplace. This led to a series of worker participation oriented labor laws that started with employee representatives on company boards of directors in 1973, led to enhanced job security for wage earners in 1974, and culminated with the codetermination act of 1977.

This legislative base admittedly gives Swedish trade unions enormous protections, especially compared to American experience, but the law is not perfect. Although the union is entitled to any information the employer may have, there is no specified amount of time that the union must be informed before the implementation of changes. This has resulted in supplemental agreements in some instances to place time requirements on information, but not all employers have agreed to such conditions. An additional problem results from lack of knowledge about the effects of specific technological changes on the workplace. To alleviate this, a special fund has been established within the trade union movement to finance study of the effects of new technologies, although the trade unions recognize the vastly larger resources available to the companies to conduct studies in their own interests.

The job security law of 1974 effectively answers questions related to the retraining of displaced workers. In effect, the employer cannot fire a redundant employee, so he must make allowance for retraining. If the employee cannot adjust to the new technologies, the employer may fall back on the government labor market education program for the structurally unemployed. The Swedes attribute the high participation rates for this training to the payment of a wage to the worker while in the program. Indeed, the worker can remain in the program for a year or two, and if at the end of that time, suitable work is unavailable, the worker can enroll again in another area.

The TCO enumerates five sometimes conflicting strategies prevalent in Sweden for dealing with new technologies:

1. Make the introduction of new technologies more expensive to employers via new methods of taxation, such funds then to be used by the society in alleviating the problems resulting from new technologies;
2. Temporarily stop the introduction of all new technologies until studies of their impacts can be done;
3. Give local unions a veto power over the introduction of new technologies;
4. Enable the unions to be brought in at an early stage in the decision-making process on introducing new technologies;
5. Stimulate the introduction of new technologies to maintain Sweden's position in regard to international competition.

The TCO's own policy on technological change incorporates elements of all these strategies. Quoting the final report of their 1979 Congress:

"Properly applied, technological advance can lay the foundations of social progress. Technological progress is a question of power. It must not be governed by an approach implying that man is gradually becoming a more and more superfluous appendage to machines. Computerization makes many routine jobs unnecessary, but it also generates many new ones. It is trade union members who have to do these jobs and be exposed to the physical and mental stresses involved by computerization. Trade unions must therefore be able to exert profound influence on the manner in which computerization is effected in Sweden."

LO, like the TCO, is an umbrella organization covering 25 individual Swedish trade unions. The oldest and largest of such confederations, LO's constituent unions have a combined membership of well over two million predominantly blue collar workers. This number represents over 80 percent of all organizable blue collar workers.

The LO, in contrast to the TCO, is a highly centralized confederation and may enter into the negotiations of any of its affiliates, providing guidance and suggestions for the solution of critical issues.

The LO, through the eight decades of its existence, has also been deeply involved in Swedish politics, maintaining close connections to the Social Democratic party. This relationship is directly responsible for the strength possessed by each of these organizations in Swedish society and politics and has allowed the LO a major role in the formation of much of the outstanding labor legislation that resulted from the 44 years of Social Democratic party rule.

Although two separate and distinct confederations, the LO and the TCO cooperate closely. This cooperation has become stronger in the last decade as both have become more involved in matters relating to structural changes in the Swedish economy. LO's aims, and indeed TCO's also, are to strive for a society based on political, social, and economic democracy for all workers.

One departure from commonality of interest between the LO and the TCO is in the area of technological change. Although they have studied the issue for the last 15 years, the LO still does not have much interest in the specific employment effects of technological change, preferring to rely on the overall Swedish policy of full employment to take care of any problems.

The LO believes that the Swedish economy is dynamic enough to continue to absorb an average of one million job changers each year as expansion in the service sector continues. The movement

*L. to R. Anders Backström, LO Research Department, and Clarence Robinson, BRAC*

of this many people per year has not yet strained the Swedish social system. The society, in fact, has profited from this movement although the individual has not in all cases. Retraining of an average of 30,000 people per year, as provided under social welfare, has enabled relatively easy movement, although it is admitted that schools still train for occupations that are disappearing, since the choice of occupations is left freely to the student. In addition, there appears to be no conflict between unions due to people retraining for different jobs which may fall under the jurisdiction of different unions. To the LO, the important point is that people do indeed get other jobs.

LO policy is a clear reflection of the view that society should not pay to keep people in disappearing jobs or pay to maintain skills that are dying in an increasingly modern world. The degree of Sweden's involvement in international competition is also reflected in the view that if a company must move its production facilities from Sweden to survive in world markets, it should do so rather than stay in Sweden and fail.

When an economy runs out of economic sectors to absorb excess workers, what then? There is a basic objection in Sweden to reducing hours of work to help increase employment. As a balancing factor, overtime work is not socially acceptable because no one wants to work it. Although vacation time continues to increase, this is more an indication of the importance of leisure time to the Swedes than a reaction to impending problems of technology. Retirement, at earlier and earlier ages, is receiving the most attention. With most persons covered under public pension schemes that are transferable between employers, retirement, although not early in the American sense, is viewed as the most acceptable means for increasing the total number of jobs in a shrinking market.

Codetermination is one of the most important achievements of labor organizations and Social Democratic government in Sweden. Yet for all the long history of labor management cooperation, some Swedish unions are finding that the employers with whom they deal are working against the codetermination act (The Board of Representation Act), and contact with the Swedish Employer's Federation on these issues is becoming more and more difficult. In fact, there is wide-ranging pessimism among labor groups on even being able to approach employers for discussing the crucial issues of successfully implementing a plan for codetermination. Swedish employers, in the words of representatives of SIF, the largest white collar union, are beginning to look like U.S. employers, even to the point of using one of the most counterproductive of all the practices of U.S. employers—the services of anti-union consultants.

Falling back on the law is always a last resort, and it is always comforting to know that it is there to rely on if absolutely necessary, but this practice is not a positive one. The move away from the traditional cooperative posture is viewed as retrogressive, a step backwards in relation to all that has been achieved.

## Government

As mentioned earlier, the current government in Sweden has been in power for only five years, following nearly four and one-half decades of Social Democratic rule. Policy differences between the two are quite apparent to a Swedish citizen, but they are less discernible to American visitors. While there may be less of a desire for creating new social programs today, and more of a concern for how older programs will be financed, there is no wholesale attempt to dismantle the remarkable structure constructed in the past. The importance placed on the impacts of technological change by the Swedish government is apparent when one notes that some 30 government commissions have been formed to investigate the potential problems arising from such changes.

The Computers and Electronics Commission of the Ministry of Industry, for example, is charged with conducting studies in two areas—the effects of computerization on engineering processes and the use of computers in data processing. Seeing that the engineering sector is the key to the future of Sweden in the world economy, this section of the commission is conducting the most wide-ranging studies. Its investigations have taken delegations to foreign countries, including the United States and Japan, to study the effects of automating manufacturing processes on employment, industry structure, productivity, etc.

Sweden has the largest number of industrial robots per capita in the world. Most of the robots used in Sweden are produced there, some 85 percent, while about 60 percent of the country's production of robots is being exported. There is presently little government concern over the effects of using robots in Sweden because the change to robotics is taking place very gradually.

*Jan Carlsson, Secretary, Computers and Electronics Commission, Swedish Department of Industry*

There had been rising concern over robotics among the Swedish trade unions due to studies produced by the U.S. National Science Foundation, General Electric, and Westinghouse. This feeling though seems to be changing with experience. Now the government sees a much smaller potential for robotics compared to original estimates. High costs, mechanical limitations, and slow speeds of existing robots is changing the opinions of Swedish industry as to their usefulness, at least for the present. The design of products has a much greater effect on the successful automation of production processes than the use of automation in the production process itself, even though the result on labor is essentially the same. In any case, studies in these areas are continuing.

The work of the Commission on the Effects of Computerization on Employment and Working Environment of the Ministry of Labor raised an important point that changed slightly the direction of their work. Charged with answering a quantitative question, how many jobs will there be, where will they be, and what will they involve, the commission has come to the realization that the question may well be impossible to answer definitively, especially as the technology changes rapidly.

The study being performed by the commission will concentrate on the combined effect of production and productivity on jobs. In the 1970's, working hours decreased while employment increased. This was caused by the addition of a (legislated) fifth week of vacation and increased educational leave made available to workers. Productivity increased and production increased during this time. Using this situation as a model, the commission will use a methodological view of the best way to calculate employment changes given changes in technology. Although realizing that models based on past performance tend not to be applicable to new situations, the commission considers this the most logical path to follow in trying to determine the quantitative effects of technological change.

In many ways, this dependence on academic, macroeconomic modeling techniques points to similarities of approach to American government planners. The results will probably be just as useful. Still, one gets the impression that the Swedish government, far more than the U.S., is committed to extensive study of potential human impacts of changing technology, and to social action, wherever warranted, to help people adjust to those changes.

A further example of the commitment of the Swedish government to issues of concern to labor is the fact that public funds wholly finance the work of the Swedish Center for Working Life. Established in connection with the codetermination act of 1977, the center functions as a research institute for industrial relations and other worklife problems. Not a government agency, *per se*, the staff of the center have a fair amount of independence. They are dedicated to the enhancement of knowledge on all aspects of working life, and to increased influence of all employees, including all aspects of codetermination.

There are currently several studies underway at the center dealing with the positive and negative aspects of technological change in various industries. For example, one study finds that the banking industry is on the verge of great changes in its methods of operation in Sweden. These changes show a heavy concentration on technology, with the widespread application of computerization to all levels of work within the industry. Automated systems could potentially eliminate about one-third of the current banking staff in Sweden in the next 10 years, with these effects concentrated in the front office—tellers and savings personnel—and the almost complete elimination of routine back office work.

Technological changes center on data processing, terminal systems, automatic teller machines, word processing, and personal computing (the performance of computation and analysis by customers themselves rather than bank personnel). Although bank management foresees a maintained level of employment in the decade of the 1980's, this study is in direct conflict, citing a combination of the potential for reorganization, branch office shutdowns and mergers, a relatively stagnant economy, and few new ideas and products.

Where declines are anticipated in lower level employment categories, increases are expected in such areas as economic advisors, analysts, calculation and data processing personnel. The wide gap between the types of personnel affected point to increased training problems and doubts that there will be transfer of many employees from one group to another. It is expected that turnover will account for some of the drop in employment, especially if changes are implemented in a fashion that effectively makes use of normal attrition. However it is expected that reducing hours to spread employment opportunities may have to become acceptable in the banking industry.

Technological change has already affected the printing and publishing industry in Sweden, creating growing conflicts between graphic arts workers and journalists. As is becoming common in the United States, video display terminals are starting to replace journalists' typewriters in Sweden, effectively eliminating the typesetting phase of the printing process. Their introduction met some resistance at first by some journalists, and the use of VDT's was thus not required. This attitude however, was easily circumvented in the hiring process, as newer, younger entrants into the field were introduced to them at the start.

A decline in the quality of journalism has been noticed with the introduction of VDT technology, not in the artistic quality of journalism but in the technical quality. It seems that management, upon the introduction of VDT's to the industry, eliminated proofreaders, requiring journalists to do not only their own typing, but their own proofreading as well, with predictable results. With graphic arts workers removed from the proofreading process, management then hired secretaries to do final typing and proofing of copy, at much lower wages.

This industry is the sole example of a collective bargaining agreement on technological change existing in Sweden at the present time. It provides minimal protection by itself but is significant nonetheless. It states simply that when technology is introduced that displaces graphical arts workers, they have a right to be retrained for jobs within the industry rather than having to rely on the general retraining provisions of the Swedish social welfare legislation.

As one last example, the Center's study of the Swedish insurance industry shows its now almost total conversion to the use of new technologies. The insurance workers union has a membership near 20,000. Employment in the industry doubled in the 1970's reaching 17,400 at the end of the decade, although this might have been some 4,000 higher if new technologies had not been introduced, the study finds.

New technology in the industry has been in the form of VDT's and the computerization of records. Qualitatively, the use of this new technology has been seen to lead to a decline of the membership's knowledge about the industry and the work they do. Fragmentation of the work has probably led to decreases in the quality of service provided by the industry. Further, VDT use does result in eye and neck problems, headaches, and increased stress. Collective agreements have limited intensive VDT use in this industry to one hour in duration, twice a day. In addition, eye examinations and eye glasses are to be provided by the employer if needed by employees working on VDT's.

The insurance industry has been involved in some unique experiments in worker education in Sweden. State sponsored study circles, where workers participate in educational sessions designed to increase their awareness of factors affecting their jobs and industry, have been attended by over half the membership of the insurance workers, and with excellent results.

The limit of local union influence on technological development is a problem in Sweden and efforts are being made to increase this influence. The work of the Swedish Center for Working Life is centered on how the local and national levels of unions, each with their own spheres of influence, could better work together to solve the problems of new technologies.

## Industry

An American whose knowledge of the Swedish system is limited to what is presented in American magazines and newspapers could easily conclude that there are no real differences between Swedish unions and employers. We frequently hear of the establishment of progressive social programs, or experimentation with worker control of production, for example. However, while the relationship between Swedish unions and employers generally appears to be much smoother than is the case in the United States, conflicts do arise.

Introduction of new technology is one area where these differences come to the surface. Ultimately, they derive from the goals to be met from control of the workplace, and these goals are inherently different—higher profits and greater managerial flexibility for the employer, versus higher wages and more humane working conditions for the employees.

It may be instructive to look more closely at a couple of individual companies, one a private employer and the other public. One should keep in mind the very high rate of organization in Sweden (including many people in middle management positions), as well as the extensive labor laws mentioned earlier.

First, ASEA, in some ways the Swedish equivalent of General Electric. ASEA is a major force in Sweden and extends to 15 other countries around the world (including the United States). In 1979, the company had worldwide sales of nearly $3 billion and employed over 43,000 persons in all of its operations.

*Industrial robot in operation in ASEA plant*

At the Electronics Division of ASEA, office operations are undergoing automation, involving word processing, data processing, and other computer related techniques. The start of automation of the office environment began in Sweden in the mid-1950's with the use of punched paper tape input to computerized data processing equipment. This progressed to the use of magnetic tape, then magnetic cards, to cassette tape input, to the current use of disk storage systems for data, word, and text processing. This most recent change, according to management, had come about with little resistance from employees, who were said to have welcomed the new equipment. A small amount of hesitance was encountered at first but peer pressure brought those resisting around to accepting the new equipment.

Although the new office equipment easily allows management to compile data on the productivity of individual employees using the equipment, management denies using this feature on an individual basis which would be a violation of the Swedish computer law. Groups of employees were said to be monitored but only to rate the effectiveness of the new equipment. Ergonomics, the study of machine design and human/machine interactions, was considered when planning for new office equipment, with such factors as screen glare, hand rests, movable VDT screens, and printer noise being determinants of the equipment finally chosen.

Although all indications from management were that the new equipment was heartily accepted by employees, it was later learned that resistance varying from serious to extreme, including wildcat strikes by production employees, was encountered upon the installation of the equipment. Consultation with union representatives was said to have been minimal—no more than that required by the various pieces of labor legislation in effect.

ASEA has also established a centralized computer center, a very high security installation in which the computers directing all of ASEA's operations are housed. ASEA uses computers for technical simulation, design automation, product inventory, marketing and sales records, accounting and personnel records, office automation, and plant automation and testing. Their computing facilities are all centralized into this one center, raising concerns of security and explaining the security check needed to enter the building.

ASEA considers training in the use of computerized systems crucial to the successful implementation of such systems. There apparently is no training arranged by the union, although there is labor/management cooperation on the issue of training. The general attitude on the part of the union seems to have been that of falling back on labor

legislation to deal with potential problems. This may be due to the fact that large numbers of employees have not yet been significantly affected by new technologies since demand and production continue to rise. However both sides admit that problems are likely to arise when and if demand for products and services levels out.

In addition to the actual computer center housed in this building, much of ASEA's computer programming and systems analysis is done here. Programmers and analysts work at VDT's that are manufactured in Sweden and in the United States by IBM. An interesting comparison can be made between the different types of VDT's, those from the U.S. having green screens with lighter green characters and a minimum of adjustments, while the Swedish models were fully adjustable with a minimum of screen glare and easier to read yellow characters on a dark brown screen.

The company is also actively developing new technology for computer-aided design. It is claimed that 40 to 60 percent of the time previously devoted to project and circuit design has been saved through the use of computers.

For example, computer-aided design equipment can be used by drafters to design electronic circuitry diagrams. The designs being drafted are originally devised by engineers and roughly sketched-out by hand. This basic design is then given to the drafter to develop the final diagram using computer assisted equipment. This equipment recalls from memory individual circuit symbols and places them in any orientation and at any size on a circuit diagram displayed on a VDT. Diagrams are built-up until complete and then automatically printed.

ASEA management claims that even though roughly 50 percent of the circuit design operation is still done by hand in making and refining the rough circuitry sketch before finalization on the computer, within five years the entire operation may be performed by the engineers themselves, using their own terminals, and eliminating the drafters' current involvement in the process.

The A.C. Machine Division of ASEA produces small and medium electric motors, generators, convertors, and electromagnetic disc brakes. A large number of numerically controlled machines and industrial robots are used on the facility's production line. The industrial robots on the line are relegated to performing tasks that were considered dangerous to humans or extremely boring. For example, aluminum casting and high pressure stamping operations that each had previously required about four persons were now being performed by robots, one per operation, with four robots being attended by only one person. Whether the job of tending to the needs of industrial robots is routine or not is arguable, but it is clear that humans are being removed from production areas where their health and safety were clearly endangered. Coincident with this is the overall reduction of the number of people needed for a given level of production.

Other robots on the production line perform routine machining and assembly operations. One, for example, drills a series of six holes in brake housing castings, a slow operation where the robot picks up undrilled castings from an area behind itself, turns around, places the casting on a drill press for the drilling of three holes, picks up the casting, turns it over, places it in another drill press for drilling three holes on the other side, picks it up, clears off metal scrap with compressed air and places it in a pile of finished castings. The entire operation takes several minutes to complete, apparently due to the mechanical limitations of the machine. A human probably could have accomplished the task in less time, but the monotony of the operation, somewhat exaggerated by the slow movement of the machine, is apparent. This machine is in constant service, 24 hours a day, and requires only minimal maintenance. The only recurring need for human attention is for supplying it with undrilled castings.

In later discussions with production management, it became clear that the introduction of robots and other automated equipment was not done solely for humanitarian reasons. (Safeguarding the physical well being of their employees does seem to be a real concern of Swedish management, whether because of legal consideration, union influence, or social pressures, or a combination of the three.) High wage levels in Sweden was certainly a major factor leading to the initial decision to utilize numerically controlled machines and robots.

This decision was at first resisted by the union. However, the machinery became accepted when it seemed that without it, the facility in question might have had to close because of its lack of ability to compete in both domestic and international markets. Without the automation that had thus far occurred, this plant would have employed about twice as many people as the nearly 700 it does now. As it is, production doubled in ten years, with a stable workforce.

## Televerket

In most civilized countries, one would expect the relationship between union and management in government agencies to be particularly good. This appears to be the case in Sweden, at least as demonstrated by the telephone company.

Televerket (TVT) is a government-owned monopoly which otherwise resembles the U.S. Bell System. It is a fully integrated company both vertically and horizontally, that provides service in 20 geographic areas covering the whole of Sweden. In addition to equipment and basic telephone service, TVT provides data communications, text communications, telefax and advanced business equipment and services. TVT has no competition in the provision of telephone service but it does maintain a subsidiary operation that provides alarm signalling service in competition with private companies. The provision of facilities for radio and television services is also within its province. TVT employs over 43,000 persons and has the equivalent of some $8 billion invested in its network.

Unlike the Bell System, TVT and the unions covering its employees (there are three) are closely cooperative, maintaining an open dialogue on all matters mutually affecting them. To maintain a position in the forefront of telecommunications technology requires such a utility to be constantly changing and updating its equipment. All such changes, how they will be implemented, and how their employment and occupational effects will be handled are subject to negotiation and agreement between the utility and its unions.

Technologically speaking, TVT is currently some five to ten years behind the Bell System in its development. Where the Bell System claimed a fully automatic dial system in the early 1960's, TVT achieved that goal in 1972. TVT is just now beginning to implement electronic switching equipment (fully digital) and predicts its completion in ten years. The Bell System began this process in 1965 and is now over 30 percent complete, although very little of its equipment is digitally controlled. The gap between development of the two systems is narrowing. The future plans of each are quite similar—fiber optic communications systems, large scale integrated circuitry, increasing data communications capabilities, etc. One point of departure is Sweden's (indeed, most of Europe's) interest in developing Videotext communications. This two-way interactive video communications method uses the telephone network for information transmission and is close to implementation in Sweden, as it is in the United Kingdom, France, and West Germany.

Given the increasing use of new computer technology exemplified by VDT's, concerns are running high over the health and safety of workers exposed to them at TVT. Internal studies have uncovered problems such as apprehension, eye strain, neck and back strain, monotony, and fear and negativistic attitudes from the use of VDT's. Such problems have led to agreements whereby work on VDT's is limited to two hours per session, twice a day, with at least two hours break between sessions. Employees are also entitled to free eye examinations and corrective glasses if their work involves the use of VDT's. The utility claims that if it could safely have people working only two more hours per day on VDT's, the cost of the terminal itself could be doubled and still be cost effective. This is certainly an incentive for doing much more research on the design of VDT's. Their major problem in this regard however, is that they import almost all their terminal equipment from the United States where less emphasis has been placed on operator comfort.

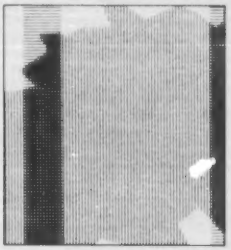
The labor/management relationship at TVT, thanks to labor legislation and overall concern for the human being, appears to be excellent. Local trade unions are entitled to consultation and agreement on any new programs initiated by the utility, and as a rule, are involved in decision-making from the start. Their major influence has been on the way work is done at TVT. Changes here take the following form:

1. Union/management agreement to study a potential change;
2. Prestudy of change is performed;
3. Union/management agreement on direction to take in implementing change given results of prestudy;
4. Development of change is studied to determine its goals and objectives;
5. Union/management agreement to implement change; and
6. Change is implemented along agreed lines.

Every step of this process is open to the unions involved. Since this process resulted from the 1977 codetermination act, it is still somewhat experimental. If agreement cannot be reached in any of the above steps, the utility has the right to make the final decision; however, discussions may always move to a higher level, and ultimately, to the Swedish Labor Court.

The main point is that in all Swedish companies, the decision to install new technology is, in fact, still a unilateral decision of management. Codetermination in Sweden is still in its infancy, and has not changed this basic situation. Swedish law and custom goes against routine layoffs, but questions of changing work content and structure are still very much areas of concern to the unions. At the local level, where these questions are often encountered, the unions have not always been able to match the expertise and planning resources of management. This is an area of major current activity within the Swedish trade unions.

# Federal Republic of Germany



West Germany, although tracing its cultural origins well back into history, politically entered the modern world on May 23, 1949 when the Federal Republic of Germany was created from the ruins of World War II. Although only four years after the official end of the War, the country was in a favorable position for rapid development, as many bonds were forged during that time with the international forces occupying the territory, assuring its transition to a democratic state.

The West German economy has developed into one of the strongest in the world since the end of the war. Relying on its own natural resources, including the resourcefulness of people, it has become a world leader in metal production and processing, motor vehicles and chemicals. Its major industries are facing, and meeting to a large extent, onslaughts of inexpensive foreign products. Deriving a large part of its GNP from the export of its products it cannot place limits on its imports and still expect to be competitive in world markets. West Germany is relying on traditionally high rates of productivity and the quality of its products to meet this challenge.

West Germany, like Sweden, has accumulated an impressive body of social welfare and labor legislation. Although the tradition and spirit of this legislation goes back to late in the last century, most has been revised and amended since the formation of the Republic. In the area of social insurance, West Germany can claim the following:

- Unemployment insurance, financed by a three percent payroll tax shared by the employer and the employee that pays up to 68 percent of previous net earnings, plus family allowances;
- Health insurance financed by a payroll tax of 12 percent shared by employer and employee, that pays full gross earnings for the first six weeks and 65 to 75 percent thereafter up to a maximum of 72 weeks, and includes free medical and dental care, and hospitalization and medicines at nominal fees;
- Accident insurance paid for by employers only, that covers all paid employees, farmers and family helpers, school children, and students; and
- Old age, disability, and survivor's insurance financed by a payroll tax amounting to 18 percent of earnings up to about $2,500 monthly, and shared by employer and employee. Pensions, as paid under this insurance, start generally at age 65 and cover some 65 percent of net earnings.

Labor legislation in the Federal Republic of Germany clearly revolves around the concept of codetermination, which can be traced to the revolution of 1918 and workers' demands for a voice in management. A works council act of 1920 gave workers minority representation on boards of directors but this right was abolished by Hitler. The concept was restored by the occupying allied powers after the war and since that time, legislation has confirmed the concept of works councils and expanded workers' rights under codetermination.

In its modern incarnation, West German codetermination results from three separate legislative acts:

- The 1951 Law on Codetermination in the Coal and Steel Industries mandates that on the boards of directors of these companies, representation will be 50 percent for the stockholders and 50 percent for the employees;
- The Codetermination Law of 1976 mandates that companies with more than 2,000 employees operated as stockholders companies must give their employees equal representation on the board of directors;
- The 1951 Industrial Relations Act (amended in 1972) gives employees of companies not covered by the other two aforementioned acts the right to one-third representation on the board of directors.

Public employees are guaranteed their own, rather limited form of codetermination by the 1974 revision of the 1955 Personnel Representation Act which establishes joint labor/management Personnel Councils that concern themselves primarily with working conditions and social issues as they relate to public workers.

Codetermination, although complex in its legal underpinnings, revolves around a very simple concept—"participation—a human and economic need" to quote a major West German industrialist. Social Democratic party representative in the Bundestag, and owner of Europe's largest producer of ceramics.

A worker's voice in running a company is just one aspect of the West German form of co-determination. It also involves capital sharing, an aspect not nearly so well developed, or subject to as many legal reinforcements, but again simple in concept. Worker ownership of shares and investment certificates of the company will inevitably lead to the worker profiting from his labors more than in the form of increased paychecks. It can also lead to a lower rate of absenteeism, and a high degree of personal interest in cooperation and productivity improvement, it is believed.

A major aspect of codetermination in West Germany is the establishment of the works council at the shop floor level of every business in West Germany. The works council has legal foundation in the Industrial Relations Act of 1972, which requires the election of a works council every three years by the workers of any enterprise employing five or more persons. Quoting the law:

> "The employer and the works council shall work together ... for the good of the employees and of the establishment ... in cooperation with the trade unions and employer's associations ..."

The works council's membership varies according to the size of the establishment. Men and women have proportionate representation and youths are also represented. Establishments larger than 3,000 employees may have as many as 13 full-time works council members earning their full pay while performing council business. Works councils do not negotiate agreements as such, but have a voice on local issues such as:

- Hiring and firing policies;
- Training, and health and safety issues;
- Job evaluation, wage rates and structures;
- Working hours and schedules; and
- Issues affecting employment, such as technological change, displacement, retraining, worker welfare, etc.

The works councils should not be confused with American-style union locals. The membership of the works councils are elected by all the various groups of employees in each establishment, white collar and blue, to represent them with the employer. These councils are formally and legally independent of the national unions. On average, about one-fifth of their members are not members of any union.

Collective bargaining itself has reached quite advanced levels in West Germany. Bargaining, with a few exceptions, takes place on a regional level between a national trade union and an employer association. The resulting industry-wide standards specify wage increases and working conditions for union members which are generally adopted by firms in the same industry that are not unionized. Indeed, public acceptance of collective bargaining in West Germany is so high that non-union workers in an establishment generally want the same settlement applied to them even though, by German law, a collective agreement can be binding only upon the union members of such an establishment.

The importance of collective agreements in West Germany is further emphasized by the fact that some 8,000 are negotiated every year. The unions themselves have, in addition to the right to negotiate agreements, the ability to form coalitions among themselves for additional strength in bargaining. They also have the right to strike at any time that an agreement is not in effect, such as after negotiation deadlines have passed. However, if an agreement expires or is terminated, its conditions remain in effect until a new agreement is negotiated. In general, agreements are made on a regional basis although some companies that are national in scope negotiate national agreements covering all operating units of the company.

In general there are two types of employer lockouts used in West Germany — as a reaction to a union strike, and as an employer action that takes place on a regional or national basis. The first type is apparently quite common, the second has seldom been used and generally only occurs in times of high labor unrest. Lockouts of any type have lasted from less than one day to up to six weeks in a particularly widespread disagreement in the printing and publishing industry. Just as there exists interunion support during strikes and lockouts, there is some coordination of employer support during these times also. Employers have established a fund to help support companies that are in the midst of a strike or lockout. Additionally, as a strike fighting measure, West German employers will attempt to mobilize non-union employees to take the place of striking workers.

Rather than a federally administered mediation service to handle disputes, the parties to a contract have developed their own voluntary, jointly administered conciliation system. Disputes resolveable through this system may go through three levels of labor courts functioning on local, regional, and federal levels.

## Labor

Trade union membership in West Germany currently stands at over 40 percent of all organizable workers. Unions are organized along industry lines with the largest being IG Metall, counting over 2.5 million members. Most West German trade unions are affiliated with the German Trade Union Federation (DGB), a federation of 17 industrial unions, comprising some eight million members.

The German Trade Union Federation (DGB) is very similar in structure to our AFL-CIO. It was founded in 1949, only a few months after the establishment of the Federal Republic itself. The DGB claims no direct political affiliations, however its history has been closely tied to that of the West German Social Democratic party and it is from this "partnership" that much of the Federal Republic's labor legislation has originated.

By the DGB's own estimates, the West Germans are approximately three to seven years behind the U.S. in implementing new technologies. Technological change in Germany, as in the rest of the industrialized world, centers on the use of micro-electronics—flexible, cheap, and used everywhere from small to large companies. It has seen broad use in both public and private services with retail and wholesale trade being particularly affected. Its use has extended to management and administration, thus threatening the most classical of all white collar workers.

The DGB sees few new jobs opening up in public and private white collar employment and anticipates more jobs lost in this area than in factories. The use of microelectronics will spread even further as computer-aided design equipment becomes a threat to designers, drafters and engineers.

The resulting picture is not very optimistic. We may see large scale polarization in employment, with a small number of highly qualified jobs which will require intimate knowledge of the systems being used, and large numbers of simplified, low skill jobs, for which knowledge of computer systems is not necessary. The large group will see increases in physical stress and psychological strain, primarily with increasing use of VDT's, and the chances of workers losing control of their jobs will increase greatly with new technologies.

*L. to R. Gunter Friedrichs, Head Automation Department I.G Metall, and Rodney Bower, IEPTE*

The DGB sees a need for active growth and industrial innovation, with a strong investment policy by the state. The current West German government has handed over to the unions and the companies the responsibility for developing change, effectively disengaging itself from the problem "... it is the task of the employers and unions to care." The DGB will not dismiss the government from the responsibilities it perceives it to have, and is actively working to increase government involvement in the handling of problems related to technological change.

Toward this end, the DGB has involved itself in stimulating public debate, and has made attempts to widen the scope of West German collective bargaining to establish a framework to regulate the introduction of new technologies. Under consideration for example, are advance notice of implementation, protections against dismissal due to the introduction of new technologies, protections against the tailorization of production to fit the new technologies, and protections against wage reductions. Also being considered are the potentials of work enlargement and enrichment without the usual stress and strain attendant to technological change.

In contrast to general opinion in Sweden, reduction of the work week as a means to increase available employment opportunities is well accepted in West Germany. Collective bargaining agreements at this point almost all have five day, 40-hour work weeks as a maximum, even though the federal wage and hour law still specifies a five and one-half day, 48-hour work week. Through collective bargaining, the West

*Rodney Bovet, IFPTE, and Günter Volkmar, President, HBV*

German trade unions are attempting to lower the work week to five days and 35 hours (a four day week is not looked upon favorably) although there is no effort underway to have the wage and hour laws reduced to reflect the realities in practice.

Unions and the members they represent are beginning to experience difficulties brought about by technological developments. For example, the Commerce, Banking and Insurance Workers Union (HBV) has a total membership of about 350,000 persons, 85 percent of whom are white collar workers in private industry. The bulk of their membership is in the commercial sector, some 65 percent, with the remainder in banks (16 percent), the insurance industry (10 percent), and miscellaneous commercial services (9 percent). The HBV has major problems in effectively dealing with the problems brought about by technological change partly because such change in the banking and insurance industries is a relatively new occurrence in West Germany.

In banking, there are about 50,000 tellers, yet only some 300 have been affected by automatic teller machines. The HBV estimates that by the mid- to late-1980's, all 50,000 will have seen some of the effects. Banking employers have continually claimed that changes in technology are being made for the benefit of their customers, not to reduce employment at the banks, yet they admit that the new equipment will slow down employment growth, even in the face of expanding business. The insurance industry, too, is seeing technological changes, in the forms of word processing and data processing of customer records. These technologies are enabling reorganization in both industries that allow them to centralize their operations using only skeleton crews at regional locations.

The HBV sees the need for increased research, fearing that a great number of jobs will be lost and those remaining will have their qualifications greatly lowered. They have started to negotiate agreements attempting to deal with the situation but have not yet been fully successful, in great measure because of employer resistance and the low rate of organization in these industries in West Germany.

The HBV has achieved a good deal with the VDT issue, guaranteeing improved working conditions for VDT users, better training in the use of the technology, and health considerations such as eye checks and eyeglasses if necessary, paid for by the employer.

I G Metall, the Union of Metal Industry Workers, the largest of all West German Trade unions with over 2.6 million members, foresees many difficulties stemming from technological change, even though they have an Automation Department which has been functioning since 1960. Their studies pinpoint the problem of potentially increasing volume of business without similar growth of employment, a situation brought by the enormous productivity improvements possible because of technological developments.

Today, German productivity is increasing and production capability is increasing, but the rate of real growth is going down. With a one percent rate of GNP growth expected in 1981 and an increase in working population expected also, there is an anticipation of increased unemployment resulting from economic growth not large enough to compensate for labor force growth. In fact, this trend is expected to continue into the 1980's, doubling the rate of unemployment by 1985.

Job content is also changing. Skill levels, in general, seem to be decreasing, and IG Metall has won one concession in bargaining that will assure a long period of time for workers to be downgraded, with no decline in real income due to this downgrading. This resulted from a long and bitter strike that involved several hundred thousand workers over one-third of the country.

This approach offers some protection for affected employees, but does not solve the underlying problem.

I G Metall has achieved some contractual gains in the area of work organization with one agreement covering over 800,000 workers in heavy industry in one region of the country. This agreement deals with the division of work and disallows the creation of any new job that takes less than one and one-half minutes to perform. This is considered the first big step toward trade union control over division of work in West German industry. This agreement also provided some other protections — persons older than 54 cannot be fired or downgraded and workers on piece rate pay systems get an eight minute break per hour. These provisions are all minimums and subject to improvement at the local level.

On the use of industrial robots, the experience in West Germany is similar to that in Sweden—one robot can replace four human workers while creating one job for the maintenance of the robots. This one job, although in many cases much safer to perform than the four eliminated, is likely to be much poorer in content than those replaced. The trade unions in West Germany, through codetermination, have the opportunity to influence the development of robotized processes but don't always have the specialized knowledge that would be necessary to make a meaningful contribution to this development. Government money for conducting research is forthcoming, but the building of expertise is a slow process.

*Caspar von Strach, Head, White Collar Workers Department, DGB*

One strategy that has been used with a good deal of success is publicizing the issues and engendering public debate. In the early 1960's I G Metall sponsored its first conference on technological change. The American House in West Germany offered the services of four U.S. automation specialists to develop and discuss the impacts of technology. This effort was moderately successful in bringing the issue out for discussion among the workers and the general public. The following year saw the publication in Der Spiegel (the German equivalent of Time Magazine) of a cover story about new technologies and their effects on workers and working life. The year after that saw the second international conference on technology that lead to funding by the German government of over 40 individual case studies of technological change in West German industry. The third conference in 1972 led to the first collective agreement covering the effects of technological change, a major breakthrough that eventually was adopted by over 70 percent of German industry.

While German unions are not fully satisfied with codetermination legislation, the system has been helpful. The advance notice possibilities of the law can be particularly useful, with the union often knowing the development plans of a company before the company's stockholders. This effectively translates to at least one year's advance notice.

Codetermination also leads to essentially continuous bargaining between unions and employers. Each year in January or February, new rounds of negotiations open on the subjects of wages and working conditions. However, with works council agreement required on most issues, negotiation continues almost all the time. This allows for the resolution of many difficulties before they develop into full scale conflicts.

## Research

The Ministry of Technology and Research (BMFT) is a federal level agency of the West German government that is charged with promoting the development of new technology in the West German economy while conducting or promoting studies in humanization research on the effects of new technologies. The BMFT has a total budget of over $3 billion per year. The section conducting humanization research began in 1974 at the same time the codetermination act became law in West Germany. The two subjects are considered very closely related.

A major part of this department's funding (about 50 percent) is distributed directly to industry and used by them to conduct studies to humanize the work environments found in their facilities. For example, a recent experiment was conducted at Volkswagen to develop a process to do away with the assembly line method of automobile manufacture. About $60 million was contributed to this experiment by the BMFT, an amount that was matched by Volkswagen. Additional subcontracts were let for psychological, ergonomic and organizational research studies for the primary project. The results of this

experiment, although moderately successful, were not adopted by Volkswagen. This, however, is not considered a failure by the BMFT, as valuable information developed from this experiment that can be transferred to other projects in the future.

Any projects in the humanization area which are funded by the BMFT must receive the approval of the works council in the location the project will take place. In addition, labor input is gathered through the use of tripartite internal commission consisting of labor, management, and government representatives which acts in consultation on projects that are taking place. If workers are not be be directly affected by a planned project, their consultation and agreement are not a requirement.

Research projects being undertaken currently strive for a broadening of a particular project's impacts. Studies are now directed at humanizing an entire plant, rather than only one section of a plant. In a plant where the assembly line is the primary focal point of such a study, the whole plant, including the office work places of such a plant, will have to be included in the study and will be expected to benefit from the results.

The BMFT also funds much basic research on health and safety issues, such as cancer-causing effects of asbestos and the design of equipment to enhance worker safety. In addition, funding is targeted for studies in the more insidious forms of worker hazards, i.e. VDT's and their ergonomic considerations, and the effects of high levels of noise on workers.

The VDT issue provides an example of the power of local works councils. Should a company install VDT's that are not manufactured to the standards expected by the works council of the plant, the works council can direct employees not to work at those VDT's. This in turn forces the company to acquire different VDT's. Once a precedent like this has been established, unacceptable VDT's are not likely to be purchased by the majority of West German industry, and thus not likely to be produced.

Much of the work done by the BMFT has been in large industries with strong unions voicing their demands for the study of potential changes directed at humanization. This has led to an unfortunate neglect of industries without strong unions, such as textiles, woodworking, and restaurants. These industries generally have a few employees per establishment, bad working conditions, weak unions, and not particularly good representation. In fulfilling its mandate, the BMFT is expanding its work into these industries also.

Another section of the BMFT concentrates on research projects in data processing, communications, and electronics. This group has more of an industry/technology orientation than the group that was involved in humanization studies. One of this group's mandates is to promote the use and advancement of information technology. This group originated in the early 1970's in response to recognition in most parts of the industrialized world that the information age was the logical next step after industrialization. From 1971 to 1979, the group concentrated on raising West German information industries to the level of the rest of the world in data processing capabilities. This having been accomplished by the mid-1970's to a large extent, emphasis was placed on strengthening the competitiveness of West German manufacturers of information processing equipment. Work in this area is easing now that the industry is competitive in international markets.

The department sees its future in the development and promotion of the technologies of information processing and communications. These include digital and optical communication technologies. Teletext, Videotext, electronic funds transfer, electronic mail, and a German invention called Vidiumtext. Vidiumtext takes the limited two-way interactive capabilities of Videotext and expands them to communication and dialog with any other user, using only a television receiver (suitably modified) connectd to the telephone network. This system will undergo field trials in 1981.

As to the social impacts of technological changes at the workplace, the government itself is not of one mind. The Departmental Ministers all have different opinions, to some extent split along party lines – Social Democrats and Liberals – with the most extreme view being that government should do nothing, letting things work themselves out, with the possible exception of providing retraining programs. In other words, the government accepts the responsibility for assisting the development of technological resources of the society, but insists that the unions and companies must be responsible for the social system's development to handle the resultant problems.

As mentioned earlier, the unions do not accept this view. Industry, in consultation with, and with the tacit approval of, the trade unions has partially dealt with these problems by developing a method for continually reducing the average age of the workforce. Through the use of quite well-developed and accepted early retirement plans, many older workers are taking advantage of early retirement opportunities, leaving their jobs and allowing a younger workforce to take their place. At the age of 55 most workers can "retire" and earn supplemental pay for three years, they can then go on unemployment pay for one year and at age 58 or 59 can qualify for early retirement and earn their regular pension through the state supported schemes.

*Meeting with bank officials in the Board Room of the Bank für Gemeinwirtschaft, Frankfort*

## Industry

Because of their heavy involvement in export, German industry is quite interested in the continuing development of manufacturing technology and office and computer systems. The trade unions are not as concerned as their American colleagues about the direct export of technology and manufacturing processes by the establishment of manufacturing plants in low wage countries, because German companies have found that processes involving high technology are not easily transferrable to these areas. Where this has been attempted, manufacturers are returning the work to West Germany. In addition, unlike American businesses, German companies are reluctant to take key technologies abroad because of fears of losing control of the processes.

Of more concern is the desire by all employers to use technological advances to halt employment growth within their own companies. This is not only true for manufacturing, but is also widely practiced in white collar areas such as banking and insurance.

For example, the West German Consumer Credit Bank (KKB), although far from the largest banking organization in West Germany, and far from being the most automated, does a reasonable business, and realizes the ultimate necessity of automation in this dynamic sector. The KKB's market share of all West German banks amounts to one-half of one percent of the total number of branches, one-half of one percent of total consumer savings, and 2.6 percent of all consumer loans. KKB, after its founding in 1926 as a small loan company in Prussia, has not grown at an inordinate rate, as the previously mentioned market share data would indicate. However, of the consumer banking sector of the West German banking industry, KKB is a relatively large part – 246 of 600 consumer bank branches are KKB's.

KKB, at the end of 1979, employed 2640 workers in its 246 branches – an average of almost 11 employees per branch. It is important to note this figure has remained relatively constant over the last ten years, even with rapidly growing business. Total employment at KKB has generally not increased as fast as the volume of business. This in great part can be attributed to the bank's moves to automate its operations.

Data processing equipment was first installed in 1962. Today there are approximately 700 VDT's spread throughout the bank's offices. The bank's philosophy in their approach to automating their operations has been to use data processing to support the operations of the branch banks as their business expanded. Their overall goal is to eliminate the back office process in banking and bring all employees to the front where they can be most productive in customer contact. In doing so, of course, many of the back office jobs are also eliminated.

Similar approaches are evident at larger banks. The Trade Union Bank (BfG), headquartered in Frankfort, is the fourth largest universal service bank in West Germany with 1979 balance sheet assets of about $25 billion. The BfG is indirectly but totally owned by West German trade unions. It has 250 branches in West Germany, in addition to foreign branches located in New York, London, Brazil, and Hong Kong and employs about 6,000 persons in West Germany alone.

The BfG operates like any other privately owned universal service bank in West Germany. Some 93 percent of its business is carried out with industrial customers. Its goal is to make a





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profit as large as possible and diversify without taking undue risks. It is not a mutual savings and loan type operation for the benefit of trade union members although, in deference to its size, its policies may influence banking conditions encountered by working people. It tries to improve banking conditions as much as possible but that is not its policy, and indeed it is illegal to discriminate in the favor of trade union members. It is however, able to provide quick, strong, and convenient financing for trade unions in general, particularly in the financing of strikes, and its substantial profits finance social projects desired by the trade unions.

The strength of the BfG derives from the high percentage of trade union membership in the West German workforce. This unity of strong and wealthy trade unions, and favorable West German banking laws, allows the formation of a bank such as the BfG. Trade unions invest their strike funds in the BfG to allow them to capitalize on this pool of money invested in the world economy. In turn, the BfG uses these strike fund monies as collateral in making loans to trade unions during strikes. Solidarity is such among the trade unions that when one is on strike and needs financial support, other trade unions will put their own assets up as collateral for loans made to the union in need. Trade union members are aware that the investment of their own funds with BfG allows their use in strengthening the entire trade union movement in West Germany. The Board of Directors of the BfG consists of the presidents of the 17 trade unions affiliated with the DGB, thus adding more insurance that the policies of the bank will be supportive of organized labor to the full extent allowed by law.

The progress of the BfG in implementing new technology is similar to what is found at the KKB. There is movement toward placing all banking records on a computerized data base using VDTs in branch banks for realizing transactions. Computer experts at the BfG estimate that once this conversion has taken place, there will be no manual work left to be done in transacting the bank's business. The process of computerizing operations began in 1978 and is expected to be finalized in 1981. The inexorable march to the use of automatic teller machines will be completed at that time with deposits, withdrawals, payments, and statements being handled by that equipment. With an estimated 17 million transactions now taking place, the BfG's computer experts estimate that hundreds, perhaps even thousands of additional workers would be necessary without the computerized equipment.

The bank's view is not only that automation will make the organization more efficient, but that it allows the employees to spend more time with customers. Studies done of customer attitudes towards computerization indicate a great deal of hesitancy about people actually using the machines themselves in making transactions. It is speculated that when one's own money is at stake, customers don't wish the responsibility of performing their own transactions. This, of course, will change as the equipment becomes more familiar, which does not bode too well for employees of the BfG or the industry as a whole.

The insurance industry in West Germany is experiencing a leveling out of employment, even though the volume of business is greatly increasing. What this means for the economy as a whole is a very difficult question to answer, considering that the service sector is the last to develop in a thoroughly modern economy. It is legally impossible for a company in the insurance industry to branch out into other businesses thus disallowing the use of its profits for expansion into other sectors of the economy.

The Victoria Insurance Company, organized by the HBV, is the fourth largest insurance company in West Germany, doing $1.5 billion in business annually with some 7,000 employees and 4,000 agents. Their movement to new technologies was spurred by a desire to decrease their personnel cost in relation to their total operating costs.

Even though the company uses a large number of computers to perform a large number of functions, VDT use is said to be limited, with no one person spending more than 50 percent of their work day at a terminal. The company uses about 80 VDTs now, about half of which are in their headquarters operation, and the other half distributed to their field operations. They intend to increase the number of terminals in use, step by step.

Günter Volkmar, president of HBV concedes that there is some risk as computerization spreads throughout the insurance and banking industries, and into other white collar areas, but that trade union opinion in West Germany is that this risk can be controlled – resources can be diverted to reschooling and retraining, and many new opportunities can be opened. In addition, work times could be shortened, longer holidays and study times could be allowed, and resources that remain untapped could be better investigated to provide activity for many persons. More emphasis could be placed on social matters, the disabled, and increasing the development of the German social welfare system by encouraging new lines of thought.

It is most important to be aware of the problems, and to foster open discussion. Unions, companies, and government must be brought together to start planning for solutions to the problems in advance. An important role of the unions in this increased awareness is not just to recognize the potential for problems but to devise their own ideas for solving the problems.

The West German insurance industry has often been a leader in bringing new developments to the labor/management relationship that have opened opportunities for advancing that relationship. For example, the 40 hour work week, six week vacations, and early retirement originated here and have since spread in various forms throughout the rest of the economy. The parties involved are convinced that there is still room for the industry to expand and create new employment opportunities.

# United Kingdom

The U.K. is the fifth largest trading nation in the world, exporting many types of machinery, vehicles, aerospace products, metal products, electrical equipment, chemicals, and finished textiles. Given its limited amount of arable land, the U.K. is a major importer of food products. In contrast to other European countries, Britain is now riding high on a wave of oil pumped from North Sea fields. In this respect, at least, its economy is free from the fluctuations in world energy prices to which most other modern industrialized nations are subject, although it has also kept up the value of the British pound, making British goods less competitive. The U.K. has led in the export of services such as banking, insurance, shipping, aviation, and tourism, an indication of an economy in its most advanced stages of development.

Over the last thirty odd years, government power has alternated between the Labor party and the Conservative (Tory) party, with strongly divergent views. At present, the government is in the hands of a Tory government under prime minister Margaret Thatcher. Traditional differences in party policy in such areas as unemployment, union rights, economic growth, taxation, education, the extent of government ownership of industries, and operation of the economy are at their widest in many years.

Labor law in the U.K. is based on British common law. Labor unions have no specific legal basis for their existance, having developed on an ad hoc basis late in the last century. Laws regarding the exercise of labor union functions were first proposed in the late 1800's with the Trade Union Act of 1871, giving trade unions protection from the criminal and civil consequences of restraint of trade. The Conspiracy and Protection of Property Act of 1875 extended those original basic protections and permitted peaceful picketing. The Trades Disputes Act of 1906 protected participants in trades disputes from civil suits.

Rising labor unrest in the 1960's led to passage of the Industrial Relations Act of 1971 by the Conservative government, a move that was vigorously opposed by the trade unions. The subsequent Labor government repealed the Act, which was modeled on the United States' Taft-Hartley Act, in return for promises of moderation in trade union demands and the establishment of a "social contract" between labor interests and the government. A new legislative framework was developed that imposed very few restraints on trade union activity. Throughout the term of that Labor government, laws were enacted that expanded trade union rights. These were consolidated into the Employment Protection Act of 1978, expanding the rights of individuals in the workplace, and extending the rights of trade union activity in other areas.

The current Conservative government, on entering office in 1979, amended the 1978 act to readjust the balance of power between labor and management. These amendments mandate, among other things, government funds for secret union ballots, limits on picketing, and the removal of immunity for secondary boycotts and picketing.

Even with all the seeming confusion, employee rights have expanded significantly in the past 15 years in British law:

- Written notice of terms and conditions of work, including advance notice of termination
- Severance payments
- Protection against unfair dismissal
- Guaranteed right of union membership
- Paid time off for union activities
- Maternity rights for women
- Protection against discrimination.

Legal rights of trade unions have also expanded to include:

- Right to information on company finances for use in collective bargaining
- Advance consultation in the event of layoffs
- Right to appoint and train union safety representatives
- Ability to prevent discrimination in the workplace.

Social welfare legislation in the U.K. has not reached the advanced stages of Sweden or West Germany. However, they do have a national insurance plan that provides sickness, unemployment, and pension benefits under the Social Security Act of 1975. This plan is financed by employee, employer, and government contributions, and the benefits are indexed to the cost of living to provide protection against erotion by inflation. Maximum retirement age is set by law at 60 years for women, 65 for men, and 60 for senior civil servants. Current "Job Release Schemes" provide a form of early retirement specifically designed to open job opportunities for younger workers. This enables men to retire at 62 and women to retire at 59

with paid benefits. Collective agreements often supplement these provisions of the law. The standard workweek in Britain is 40 hours for wage earners and 37.5 hours for salaried employees. Paid vacations are generally on the order of three to four weeks. Hours and vacations are not embodied in law but are the result of collective bargaining.

In many ways, the situation in the U.K. is quite reminiscent to our own in the United States—labor unions fighting for every concession they get, management that appears as unyielding as that of the United States, and a government that considers its policy of high unemployment a necessity in its fight against inflation. The relationship between the current Conservative government and the trade unions is not good, nothing like the close working relationship developed in some other countries.

## Labor

Membership in trade unions in the U.K. is estimated to be nearly 50 percent of the labor force. Almost 20 percent of this amount has been added in the last ten years as white collar workers, seeing themselves subject to the adverse effects of new technologies, organized in large numbers. Today about one-third of U.K. trade union membership is white collar and ranges from white collar workers in manufacturing to managers and supervisors.

The Trades Union Congress (TUC) in many ways resembles the AFL-CIO. The TUC has about 110 affiliated unions representing over 12 million workers. It plays a consultatory role with the British government on labor matters and a broad range of other subjects affecting work and working life in the U.K. The TUC performs a coordinating and informational role for its constituent unions, setting guidelines on union activities and assisting in negotiating and settling disputes among trade unions.

*L. to R. David Lea, Assistant General Secretary, TUC, and Rodney Bower, IEPTE*

Most trade unions in the U.K. are organized along craft or occupational lines although a few industrial labor organizations exist, most notably in the nationalized industries—coal, steel, and railroads.

The TUC has its counterpart in industry in the Confederation of British Industry (CBI) whose membership includes about 15,000 companies, 200 trade and employers' organizations, and most nationalized industries. The CBI acts as an informational clearinghouse and spokesman for British industry. It has no bargaining role but advises its members on important bargaining issues and as a group sets industry bargaining policy. As the TUC is consulted by the government on labor related issues, the CBI enjoys the same position on the industry side.

In bargaining, the British negotiate two different types of agreements—a substantive agreement for wages and working conditions that lasts generally one year, and a procedural agreement. The latter is a long-term addendum to the substantive agreement which sets procedures for modification of the substantive agreement over time and resolution of any disputes arising over the contracts. In spite of widespread unionization in the U.K., collective bargaining is a highly fragmented process that takes place on several different levels. Most common is industry-wide bargaining occurring between multi-employer associations and trade unions which will result in formal national agreements. Growing in frequency however, are shop steward agreements negotiated at the shop floor level resulting in local, informal understandings.

On technological change issues, the TUC has both led and reflected the growing concern of British trade unions. Especially in an era of historically high, and rising, unemployment levels, and faced with the real possibility of future economic growth coming about through the introduction of technologies which reduce the need for manpower, unions in the U.K. are actively seeking ways to deal with the problems.

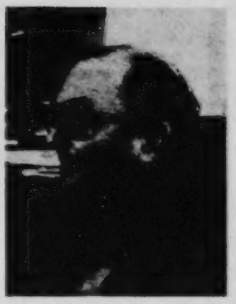
The TUC is studying several approaches. One is the possibility of having data stewards, to use the Norwegian terminology, on the shop floor. These persons, union members, have the responsibility for keeping abreast of technological developments as they occur in different plants and reporting their findings to their union's national offices. The TUC sees data stewards as a valuable option; however, they also admit that no idea for dealing with technological change is applicable in every situation. There may be overall differences in emphasis by various unions, but representatives on the shop floor, whether "data stewards" or not, are a necessity.

Union membership training is a thrust considered of vital importance. Trade union education sponsored by the TUC reaches some 60,000 persons a year who participate in courses of about one week's duration. The TUC in its education program is attempting to match

what is being taught with what is actually occurring in the workplace, with the aim that educational provisions for shop floor representatives, safety representatives, and full-time officers, takes full account of the implications of new technology. This implies, of course, that the TUC has enough knowledge of new technologies to be able to develop the appropriate training courses for its representatives. This is a subject that is of constant concern – how does the federation or an individual union gain the appropriate expertise?

The educational philosophies of the various TUC trade unions differ widely. Some concentrate more on trade union issues than technological change, some exactly the opposite. Expertise in issues relating to technology is gained in many different ways also. Many unions will bring in outside experts to develop the membership training in technological issues; however, there is a growing group who believe the expertise already exists within the membership. After all, it is with the membership that new technology originates (in the ranks of scientific and technical members), and it is they who present the front line against new technology when it is introduced; so what better source to turn to than the membership itself. This thinking is still in the formative stage, and few unions have yet developed any significant in-house technical expertise, but their knowledge is growing simply from the intensive research that continually takes place on the subject.

The trade unions of the TUC recognize one major hindrance in their search for technological expertise – not being able to pry information out of multinational corporations. International technology transfer is no doubt occurring through the multinationals and it is of primary importance that contacts with multinationals be improved through the efforts of international trade secretariats.



*Clive Jenkins, General Secretary, ASTMS*

The TUC, in all its searching for the right answers, has taken a large lead in work toward understanding the effects of technology on the workplace. As outlined in a report by the TUC General Council to the 1979 Congress, they recommended giving priority to movement towards:

- The 35 hour week
- A reduction in systematic overtime
- Longer holidays
- Better provision for time off for public and trade union duties
- Sabbatical leave
- Early retirement for older workers on improved pensions
- Increased knowledge.

Technological change and its effects has become a major issue among large segments of the British trade union movement. This includes such groups as the Council of Civil Service Unions and the Council of Post Office Unions, as well as individual unions such as the Association of Scientific, Technical and Managerial Staffs (ASTMS); the Association of Professional, Executive, Clerical and Computer Staff (APEX); the Post Office Engineering Union; the Banking, Insurance and Finance Union; the National and Local Government Officers Association, to name but a few. As in the United States, the search for solutions is made more difficult than might be the case otherwise by the large number of unions in the U.K. and the consequent fragmentation of the workforce and potential for continuing jurisdictional disputes. Nevertheless, there appears to be a widespread recognition of the potential problems, and an agreement that some issues are universal – protection and preservation of jobs; sharing of productivity benefits with the employees; and the need for management to consult early with the unions when technological changes are contemplated.

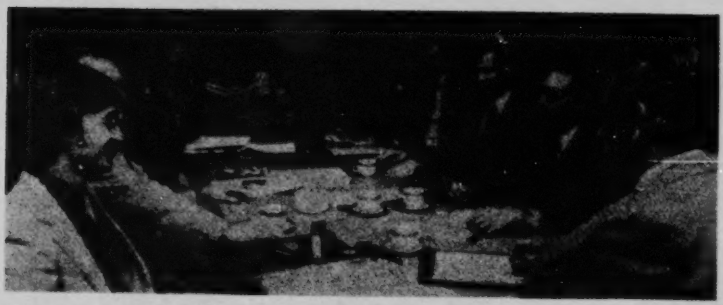
## Government

Britain is a parliamentary democracy, and as such, the Prime Minister is always of the same party as the majority of members of the House of Commons. Also, party discipline is much more rigorously adhered to in the U.K. than in the United States. The result is that the party in power has almost complete freedom to implement its policies.

There are vast differences in philosophy and approach between the Labor Party and the Conservative Party, the two dominant political parties in modern day Britain. Hence, government policy takes large swings when the incumbent changes. The Labor Party was formed in 1900 by the trade unions themselves. Over the years it has garnered much of its leadership and financial support from the unions, although a significant minority of union members vote Conservative. The Conservatives receive substantial support from private business, and have been in power since May of 1979.

While the Conservatives won on an openly anti-union platform, they cannot totally ignore the labor movement. They consult regularly with the TUC, but their current economic policies, with high unemployment as a major part of their plan to halt inflation, assures that their relationship is not a close one.

The government is quite interested in technological change as a means for improving the very low productivity growth of the British economy. Not



*DPE study group meeting at the National Microprocessor and Electronics Centre, London. L. to R.: Michael Drummel, CWA; Clarence Robinson, BRAC; Gwen Wells, OPEIU; Harry Floyd, IATSE; Reggie Newell, IAM; Richard Perry, UFCW; Steve Early, American Labor Education Center; Robert Nielsen, AFT; Dennis Chamot, DPE; Rodney Bowser, IFPTE.*

surprisingly, their current estimates of employment impact are far rosier than those of the unions.

The Department of Employment is most similar to the U.S. Department of Labor. It is responsible for a major study of the impacts of microelectronics in the U.K., "The Manpower Implications of Microelectronics Technology," published at the end of 1979. Six conclusions resulted from this study:

1. Unemployment in the U.K. would be higher without the use of microelectronics than with it;
2. The alarmist views on the impacts of microelectronics are not supported by the study's findings;
3. In manufacturing industries, process changes will cause job losses, product changes may either increase or decrease employment;
4. Some of the skills that are needed now are in short supply – the educational system cannot be expected to lead the revolution;
5. The potential effects of the new technologies will not impact the service sector for some time but the changes required in the nature of the service sector labor force will have to start occurring; and
6. Union attitudes are extremely important in a smooth transition to the new technologies.

Many structural problems are also indicated by the above analysis. Microelectronics has the effect of exacerbating problems related to the structure of an industry. One problem recognized in the methodology of the study itself was the time frame involved – only five years. The authors believe five years to be a significant period of time for which planning can realistically occur, but many of the impacts of drastic changes in technology may occur further down the road.

The British are relying on their ability to compete in world markets to carry them through any impending crisis. It is clear that government involvement will be necessary to assist people in adjusting to the increasing rate of change. The government now requires that any firm with more than 10 employees which expects redundancies (lay-offs) must notify the unions involved at least 30 days before the redundancies are expected to occur. Companies with 100 or more employees must give notice 90 days in advance. This helps a little in advanced planning for redundancies. However, all employers pay into a government redundancy fund that repays them part of the amount that they must pay employees in severance pay. An employer may withdraw up to 41 percent of his contribution to this fund, leaving his total cost of paying for redundancies only 59 percent. Simple cost-benefit analysis on these figures makes it clear that British government legislation, ostensibly in the favor of workers, can operate in exactly the other direction. It can operate as a tax incentive to modernize through the use of labor saving technologies, especially when the most advanced technologies with the greatest labor reducing capabilities are dropping the cost rapidly. This apparent conflict is recognized but the concept of this fund is still considered to be an underpinning of a systematic attempt to help people adjust to technological change.

The second underpinning to this system is training. The U.K. has a well established network of 24 industrial training boards that set standards for training and check the quality of training that is done. Both labor and industry

*L. to R. Dennis Chamot, DPE, Neal M. Vann, NVA Consultants Ltd. Rodney Bowes, IFPTE, and Michael Dommel, CWA*

have equal representation on these boards and professional educators act in consultation. The boards oversee the progress of the state financed Training Opportunities Programs that provide retraining or initial training for the unemployed or underemployed. Training programs, offered in a wide range of skills, average six months but may be extended in cases involving retraining for technological changes. Potential trainees are recruited when they apply for social unemployment benefits, but attempts are being made to match persons declared redundant and awaiting their layoff with opportunities for retraining. Those persons in training are supplied with a stipend by the government that does not approach an actual wage but is significantly above the unemployment benefits available, acting as an incentive to participate in these programs. Placement rates on completion of training average 60 to 70 percent. It has also been found that those persons who are recently unemployed and are involved in retraining have a much better chance of successful placement than those who have been unemployed longer than three months.

This program of training has been subject to recent cutbacks in funding as have most social welfare programs under the Conservative government. A previous concentration on retraining in clerical and commercial areas has been reduced but programs in the areas of new technology have not. In general, the training objectives of labor and management are not widely different in the U.K. Programs tend to be of a broad nature, not directed at specific workers and specific jobs, but at workers skilled in broad areas such as computer programming.

The British Department of Industry, like the U.S. Department of Commerce, is more concerned with increasing productivity of British industry, and stimulating technological change. Productivity was at an all-time low rate and industrial production was declining when it was decided that microelectronics would be the most important technology for at least the rest of the eighties. It also was becoming apparent that microelectronics might spell the success or failure of the economic growth in the U.K., prompting major government initiatives in promoting the development

of microelectronic technology in British industry. A Microelectronics Applications Division was created within the Department of Industry to foster the development and use of microelectronics throughout all levels of industry in the country, a program that has met with a good deal of success in its first few years.

The thrust of MAP (Microelectronics Application Program) has been in four directions: financial support, training, consultancy, and development of new programs. MAP started with initial funding of about $38 million early in 1978. Later that year, an additional $138 million was added to assist the program in reaching its goals of alerting managers and shop floor workers to the potentials of microelectronics. To date an estimated quarter million people have been reached through monetary and material support of existing programs.

In the area of training, short courses were developed using an open university concept consisting of correspondence courses and television-based instruction. About $1.25 million has been given to the TUC to fund the development of their own programs aimed at educating workers.

Acting as a consultancy, the MAP gives two to three man-weeks of initial assistance to firms desiring to further develop their own microelectronics applications program. Consultancy accompanies the fourth thrust of this program, that of assisting firms in starting up new microelectronics development programs. Slightly less than half of the total funds alloted in this program have to date been expended in the development of new programs. The MAP still estimates that at least one-half of the British industrial sector still has no practical knowledge of microelectronics and their applications.

## Industry

Labor-management antagonism in the U.K. appears to be far greater than in any of the other countries discussed in this report. Unions are not represented on company boards; strikes are relatively frequent; and companies easily resort to layoffs to attack short term economic problems.

An example of the distance yet to be traveled is shown by the recent attempt to conclude a technology agreement between the TUC and the Confederation of British Industry (CBI). While the CBI, the industry umbrella group, accepted the agreement, its member firms rejected it, demonstrating a lack of desire on the part of British employers to share with the representatives of their own employees any real degree of planning and decision making.

At the local level, some industrial actions have taken place over the introduction of technological changes. For example, Bush Boake Allen (BBA) is a division of Albright and Wilson Laboratories, a British-based firm which is itself a subsidiary of the U.S. multi-national, Tenneco. BBA's operations are international in scope with divisions in 14 countries around the world, including the United States. BBA is primarily involved in chemicals with a plant near London which produces spices, perfumes, and aromatic chemical ingredients for food stuffs.

The operations at BBA are highly reliant on computer technology for efficiency, using them in its production operations primarily as tools for complex chemical analyses. BBA also has introduced computerization to its office operations in the forms of data processing and video display terminal equipment. However, the introduction of this equipment was a unilateral decision on the part of management, and the union, the ASTMS, believing that it should have been consulted on the implementation, has "blacked" the equipment and refused to use it until management would negotiate over job division and working conditions as they result from the new equipment. Union billboards in the plant carried notices that, for the sake of solidarity, no union member should concede to management's desire to put the new equipment into operation until management was willing to bargain on the central issues surrounding the use of this technology.

A document by the ASTMS put forth the following policy concerning technology change at BBA:

"It is essential that the Company enters into a *TECHNOLOGY AGREEMENT* to ensure the orderly, smooth and effective transition that is in the interest of both Management and Workers. Moreover some agreement on no enforced redundancy as a result of microelectronics would appear necessary.

"This is not in itself enough. To man a technology agreement each group of workers or Department will need to have a *TECHNOLOGY REPRESENTATIVE* to look at the nature of these developments.

"We must have a *Technology Agreement*.

"*Technology Representatives* must be elected and trained.

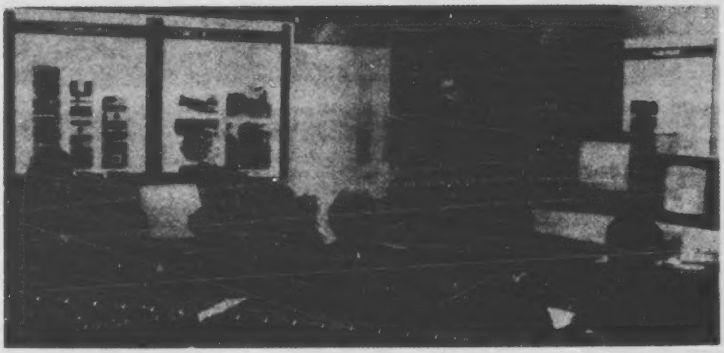
"All staff must be trained now for the changes. Special facilities must be made available for Managers and Representatives to be fully aware of the problem.

"Failure to implement the new technology in an effective way mean none of us have jobs; even at best people may have jobs less interesting than were possible.

"If we want safe rewarding work we must take an active part in the implementation and preliminary planning of the new work systems that will be required to take advantage of the new technology."

Whether the union will be successful in its endeavors in this area is unknown at the time this is being written, but the new equipment in the meantime has been sitting idle.

Some parts of British industry have also moved into the forefront of development of high technology products.



*Demonstration of Teletext and Prestel Television Information Systems to DPE study group by Mullards personnel*

For example, Mullard House is a division of the Philips Group Ltd., international manufacturers of industrial and consumer electronic equipment. The Mullard division was itself involved in the development and production of Britain's entries into the Teletext and Videotext fields.

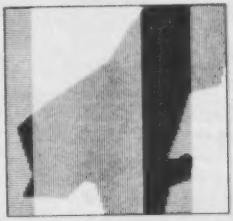
Britain has gone commercial with its use of these communications technologies. All television receiving equipment manufactured in the U.K. now contains electronic convertor circuitry for tying into one or the other system. Teletext is a one-way, non-interactive system which allows the reception of news and other informational services on home television sets. This information is broadcast along with the standard television signal in unused portions of the broadcast band. The built-in convertor allows the user to select the information he desires from a maximum capacity of approximately 200 pages stored in the broadcast signal. This maximum capacity could be enlarged considerably.

Videotext is a two-way interactive communications medium that uses the telephone network for connection between a central informational source (the British Postal Authority's central computer in this case) and the home viewer. The convertor that is built into the receiver is switchable between this communications medium and regularly broadcast television reception. Videotext offers information similar to that of Teletext, but in addition it allows the viewer to communicate with the informational source for such purposes as shopping and making hotel and airplane reservations. By the end of 1981, Mullard estimates that over one million sets with Videotext capability will have been sold. Both these systems enable the viewer, through the use of auxiliary attachments, to print data being viewed, and tape such information for later use.

The employment effects of either system are difficult to estimate considering their newness. Teletext, if it is significantly expanded, may impact employment in the conventional print media; however the abbreviated nature of the news information being carried over Teletext is unlikely to cause any displacement in its present incarnation. Videotext is capable of the same employment effects, with a few additions. In its interactive mode, Videotext enables a consumer to shop, buy, and pay for items such as groceries or department store merchandise using his home television. Widescale development of the potentials of Videotext could cause displacement of customer contact personnel in many areas of the commercial industries that tie into videotext.

Now being experimented with is the use of Videotext for business purposes. Mullard executives are able to use their home TV receivers to connect to their work locations and perform all of their work from the comfort of their living room easy chairs. Mullard has tied its videotext connections into its own mainframe IBM computer, and any employee using the right code can tie into the computer, examine and update information stored there, transmit correspondence, etc. To enable these potentials to be more flexible, there is also work being done in the development of portable terminal equipment so that a person's office can travel with him wherever he goes.

# Norway



No discussion of European approaches towards technological change would be complete without mention of the interesting situation in Norway. Believing that change is inevitable, and hence it should occur only with the consent of workers and their unions, the Norwegians are developing a system through which control of technology is a joint labor-management right.

The current technology agreement can be characterized as a rejection of labor-management cooperation on the issue, and the beginning of a struggle on the union's part for more information and greater control. Management is looked upon as an ideological equal in the struggle, but much better funded.

This all began with a pilot project of the Norwegian Iron and Metal Workers' Union in the early 1970s. The project brought local union members together with sympathetic computer technicians from the Norwegian Computing Center, a state supported institution. Their joint studies of technology in the workplace led to the formulation of worker alternatives to managements' plans for introducing new technologies. Both groups learned a lot – union members gained an understanding of computer technology, essentially "demystifying" the subject, and computer professionals learned what trade unionism was all about.

The unequivocal success of this project resulted in the first Data Agreement of 1975 between the Norwegian Federation of Trade Unions (LO) and the Norwegian Employers' Federation (NAF) which, two years later, was enacted into law. This agreement allowed worker participation in decisions which affect their jobs (codetermination), provided for advance notice of technological changes, and established the concept of "data steward" – shop floor representatives whose responsibility it is to be informed of changes occuring in the workplace so that they may use their knowledge to allow union members to understand and react intelligently to proposed technological changes.

The original Data Agreement of 1975 between LO and NAF was revised in 1978 to cover computer-based systems used to plan and carry-out operations as well as compile personal data. The agreement itself begins on a very positive note that the LO believes is a requirement for influence: "Computer-based systems can be useful tools in the planned allocation of the total resources of an enterprise . . ."

A broad approach is indicated however: ". . . it is important that computer-based systems are evaluated (from all angles), so that all the aspects are taken into account in the development, introduction and use of such systems."

Information on technology is a central issue: "Management will . . . keep their employees informed about all matters which are covered by this agreement . . . The information will be given clearly and in a language easily understandable to those without specialist knowledge in the area concerned. . . management and the shop stewards . . . will give the employees sufficient information for them to understand the fundamental features of the systems which they themselves either use or which affect them. They must . . . be given sufficient information for them to understand the importance of such systems, not only to the enterprise but also to the employees and their working conditions . . . employees who will be directly affected by the new systems . . . should, to the greatest practical extent, be involved in the preliminary project work . . . lost earnings and any expenses incurred in obtaining information will be covered."

Special representatives – data stewards – are provided for: "If the employees . . . so desire, they may elect . . . a special representative to safeguard their interests . . . The representative will have access to all information . . . Shop stewards and employees participating in actual projects will have access to all necessary documents on the project area.

"The enterprise will make sure that the special representative . . . is given the necessary training in general data processing techniques . . . systems analysis, programming and project administration . . . to develop the competence needed for participating actively in system design."

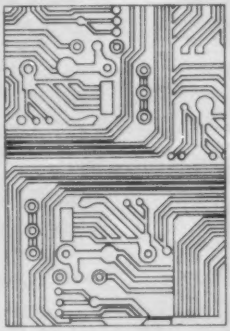
Information subject to data processing is restricted and protected: ". . . collection, storage, processing and use of personal data will not take place unless it can be objectively justified as being necessary for the work of the enterprise. . . . management, in cooperation with the shop stewards, should draw up a detailed procedure in the storage and use of personal data . . ."

Finally, the agreement is not limited: ". . . further agreement may be concluded for a particular individual enterprise . . . If . . . agreement is not reached, each party may submit the case to the central national organizations."

It is important to note that information and its acquisition is central to the success of this agreement. Information is to be transmitted through the shop stewards, a well-established concept in Norway that has its basis in long-existing central agreements. It should also be noted that no Norwegian labor-management agreements are legally enforceable, unless specific provisions have been enacted into law – the parties are bound only by honor.

One last vital consideration – because of technology bargaining and data stewards, technological change in Norway is seldom thought to be inevitable as it is almost everywhere else. It, and its attendant fears, have been reduced to one more factor affecting worklife that is subject to social action and control.

# Discussion



American and foreign trade unionists have much to learn from one another. Nowhere is this clearer than in the area of technological change and the problems deriving therefrom.

Technology develops rapidly in our modern world, both from the original conception to practical application, as well as from country to country. It is not at all unusual to see a technical advance be conceived and developed in the United States, be applied to products by Japanese manufacturers, and then appear in goods sold around the world. We have become a very interdependent world, with international trade becoming ever more important.

The technical advances are amazingly broad. They range from industrial robots to word processors and computerized filing systems; from computer control of factory production and parts inventories to automatic bank teller machines; from "smart machines" with built in microchip computers to complex electronic communications systems coupled to massive capacity data processing systems.

Every Western industrial country is participating in this technical revolution. The effects upon employment levels, job content, worker control of the job, and other subjects of direct importance to labor are beginning to be felt everywhere, for the new advances are not only changing commercial products but are also transforming industrial manufacturing processes and office work.

Many of the European countries, as well as Japan, are much more heavily dependent upon exports than the United States, and also import relatively much more. They are acutely aware of the need for remaining competitive in a rapidly changing world, a situation which is fairly new for the United States, but which is becoming quite important.

This recognition of the need to stay competitive, usually stated as the need to improve productivity, is common to every country studied in this report, and to one extent or another, it forms the basis of much of the discussion between government, labor and management. How do the Europeans view current and future developments? What problems do they foresee as a result of technological changes? And how are they trying to deal with them?

In Sweden, there is the expectation that one-third of the jobs in banking and thousands in insurance will be eliminated over the next decade; that conflicts will intensify between typesetters and editorial staff using computerized equipment; that industrial robots will spread widely throughout industry; that computerization will lead to less worker control. The West Germans are also concerned about robots and computerization of manufacturing processes, having already seen the rate of job growth slow down in some industries where such equipment is being used; and they are wary of the computers' effects on the number of jobs that will be available in the banking and insurance industries. Both of these countries have been relatively prosperous recently, so their problems are still manageable.

The United Kingdom, on the other hand, has for some time been experiencing high inflation and extremely high unemployment rates. Even so, their unions expect problems similar to those described above, but worse. With the British economy doing so poorly, there is a lot of pressure for modernization and improvement of productivity through job reorganization (read that, "using fewer people"). The British unions in particular are quite disturbed about the implication of microchip technology in the British context – replacement of workers by machines, even in the face of high unemployment.

How are our European colleagues trying to deal with these problems? Right at the start, it is important to note that each country has developed a unique set of laws and customs. Whatever they do must be seen within the context of this background, because some of what they do is not easily transferrable to the United States.

Sweden, for example, is a small country (population about 8,000,000) which must export to survive. It also has a fairly homogeneous population with a long history of social concern. Better than three-fourths of the total Swedish workforce are union members. One of the major political parties, the Social Democrats, has close ties to the blue collar labor federation, LO, and until 1975 had been in power for four and one-half decades.

There is widespread and continuing recognition throughout Swedish society of the value of labor unions in representing the interests of employees. Representatives of the labor federations are

included on government panels and commissions, and even though the Social Democrats are no longer in control of the government, low unemployment is still a major planning goal.

Some of labor's concerns have been incorporated into law. For example, Swedish workers are legally entitled to five weeks of vacation every year, helping to spread the work around. Should they lose their jobs for economic reasons, including job loss resulting from the introduction of new technology, they may participate in comprehensive government sponsored education and retraining programs. These programs may last up to two years, during which time the participant receives a wage which is purposely set a bit higher than unemployment compensation, to encourage enrollment in the programs. At the end of the course, workers still unable to get jobs may sign up for another course.

The Swedish context is determined by more than just the legal framework, as attractive as much of that is to Americans suffering through a succession of conservative administrations. Of equal importance is the widespread attitude among Swedish employers and unions alike that routine layoffs are not to be permitted as a normal part of business planning. With a fair amount of job security, workers throughout the economy can more readily accept changes that will boost productivity, even while demanding a major role in the decision-making process.

Yet, even in Sweden, the situation is far from perfect. Management is still interested in the bottom line, and this can lead to strong disagreements with the unions. Also, local union leaders may not be as well informed and knowledgeable about sophisticated technical developments as management representatives are, and thus may be unable to fully anticipate negative implications of planned changes. Ultimately, management has the final authority to make whatever decisions they want, subject only to legal and collective bargaining constraints. While there is in general a far greater willingness to cooperate with unions among Swedish managers than their American counterparts, they still have a great deal of power to determine the direction and rate of future developments. This is particularly true for technological advances, which by definition represent changes, often very complex changes, from what had been done before.

The Swedish unions, as with many others, desire more advance notice of impending changes. While they have been experimenting with codetermination systems, where union representatives sit on the board of directors of companies, this has not yet gotten very far.

The Germans have gone further than anyone else with codetermination. In the Coal and Steel industries and in companies with more than 2,000 employees, half of the members of the Board of Supervisors (in many ways equivalent to Boards of Directors in American companies) by law must represent employees, the other half representing stockholders. In companies with fewer than 2,000 employees, employee representatives make up one-third of the Board. In addition, all companies with greater than five employees are required to establish Works Councils, which are elected by the employees. These councils are not union locals and do not negotiate collective agreements, but management must work with them on local issues and grievances. This clearly includes issues related to technological change – introduction of new machinery or equipment, staffing needs, retraining, hours of work, reassignments, dismissals, and so on.

The combination of seats on the Board, local Works Councils, and national or regional negotiations between national unions and employer federations offers the German unions unprecedented opportunities for obtaining advance notice of coming changes. Even so, the *details* of those changes may be withheld for some time, and in any case, management still has the right to make the final decision.

Even if the information were complete, that is not enough. The German unions, based on their own studies and those of their government, expect to see job losses in some areas as well as reductions of skill levels brought about by technological advances, unless steps are taken now to modify the situation. While the German economy is the strongest in Europe, and low unemployment levels are still the national policy, sticking to that policy may be more difficult in the future, the unions fear, unless the government gets much more involved in job creation activities. Agreement on this point is far from the high level achieved in Sweden.

The British situation is worse, and in many ways, resembles our own. Unemployment is very high, inflation rates have been worse than ours, and the government now in power ran originally on an anti-union platform. In the face of massive economic problems, there is a strong desire in Britain to push for modernization of industry. To a great extent, this attempt focuses on introduction of computer and microchip technologies specifically to reduce labor costs.

Labor-management cooperation in Britain is at a level far below that in Sweden or West Germany. Government and management seem intent on breaking the "power" of the unions, even at the risk of great economic hardship for large numbers of people. The British unions believe there is a very real danger of economic growth occurring through the application of microchip and computer technology at the same time that unemployment grows.

What can be done? Even in Britain, the unions have adopted the realistic view that, in general, one must accept the inevitability of change. The emphasis is on seeing to it that their members are protected as much as possible from negative effects, and that any benefits derived from technological change be fairly shared. This is nothing more than a defensive strategy, and in looking ahead, several unions and the Trades Union Congress, the national labor federation, have been developing model technology agreements to pursue through collective bargaining. The following are some of the ideas suggested for including in such contracts:

- No unilateral changes.
- Full consultation with the union before any decision is made to purchase new equipment.
- Advance information for, and regular consultation with, the union to plan adequately for future developments.
- Job guarantees for present employees, including retraining and internal job shifts where necessary.
- Safeguards against excessive managerial control, or employer misuse of computer generated data.
- Safeguards against new safety or health hazards.

While similar technology agreements are being discussed in several countries in addition to the United Kingdom, they are difficult to get established anywhere. Apparently, management representatives don't want to accept any restraints on their planning flexibility, even though these agreements would certainly go a long way toward assuring labor cooperation.

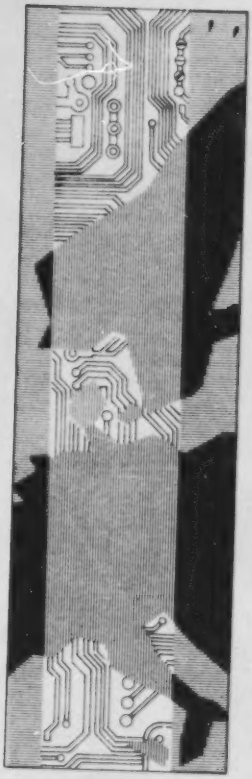
Another problem shared by all, including the American labor movement, is the need for improving the knowledge of our members and staff. The Swedes in particular have shown that widespread, well thought out education programs, backed by government funds, can go a long way in improving awareness and understanding of these issues among trade union members. In addition, we need to constantly update our knowledge of new developments. This is particularly important for local union representatives who are close to the scene when new equipment is introduced.

Everywhere one looks, be it in the United States or Europe, private and public employers alike express interest in new technological developments as a means for increasing productivity, *and halting personnel growth* in that organization. The enormous capacity of computerized systems makes this possible, but the whole is the sum of its parts. If every individual organization seeks to end employment growth, and in many cases to actually reduce total staffing, where will future job creation occur?

This is the great unanswered question. To a great extent, it revolves very much around the question of the rate of introduction of change. If change comes slowly, adjustments will be worked out. If change is too rapid—and the potential for such rapid change is there in the high technology systems already developed—then very real problems will follow *unless* steps are taken equally rapidly to modify the direction or pace of change. And no matter what happens to the society at large, local problems are sure to continue, and must be dealt with.

Our Swedish friends accept the need for constant modernization of their industries, and feel that the government must play a major role in creating additional jobs in service areas which will improve the quality of life. The German unions are looking toward some additional sharing of work through reduced work hours and total working time, and also look to the government for a much more active part in stimulating job growth. Our British colleagues are faced with a difficult political situation, and must rely more on their own devices for the time being.

No one has found the full answer. One thing, though, is clear. We must insist on early participation in planning processes, whether conducted by companies, government agencies, or national public policy makers. We must be involved *before* the damage is done. And we must be prepared.



# Appendix

The material contained in this report is based in part on a study tour, led by Rodney Bower, to Sweden, the Federal Republic of Germany, and the United Kingdom, October 6-23, 1980. Participants included:

**Rodney A. Bower,** *President,* International Federation of Professional and Technical Engineers

**Dennis Chamot,** *Assistant Director,* Department for Professional Employees, AFL-CIO

**Michael D. Dymmel,** *Assistant Director,* Office of Employment Programs, Communications Workers of America

**Harry Floyd,** *International Representative,* International Alliance of Theatrical Stage Employes

**Reggie Newell,** *Research Director,* International Association of Machinists and Aerospace Workers

**Robert Nielsen,** *Assistant to the President for Higher Education,* American Federation of Teachers

**Richard Perry,** *International Vice President,* and *Director of Professional and Health Care Division,* United Food and Commercial Workers International Union

**Clarence E. Robinson,** *Executive Director,* Industrial Relations Division, Brotherhood of Railway and Airline Clerks

**Gwen Wells,** *Director of Research,* Office and Professional Employees International Union.

**Steve Early,** from the American Labor Education Center, traveled with the group under a separate grant from the German Marshall Fund of the United States.

We wish to heartily thank our many European friends with whom we met during the trip, not only for their willingness to share information with us, but also for their kind hospitality. There are far too many to list individually, but we would like to offer special recognition to a few people who were of immense help to us in organizing the many details involved with planning a visit of this kind.

In Sweden:

**Lennart Bodström,** *President,* TCO

**Nils Elleberg,** International Department, TCO

**Carl H. Heruland,** *Secretary General,* Swedish Union of Journalists, and PTK Board Member

**Håkan Svennerstål,** Research Department, SIF

In West Germany:

**Günter Volkmar,** *President,* HBV

**Dieter Noth,** *Head,* Socipolitical Affairs Department, HBV

**Irene Schnabel,** International Department, HBV

**Caspar von Stosch,** *Head,* White Collar Workers Department, DGB

In the United Kingdom:

**David Lea,** *Assistant General Secretary,* TUC

**Neil M. Vann,** NVA Comultants, Ltd.

**Tim Webb,** *National Officer,* ASTMS

We would also like to offer thanks to the Communications Workers of America for allowing Michael D. Dymmel to spend a good deal of time assisting in the preparation of this report.

# Officers and Affiliates of the Department for Professional Employees, AFL-CIO

**PRESIDENT:**
**Albert Shanker,** *President*
American Federation of Teachers

**GENERAL VICE PRESIDENT:**
**Victor Fuentealba,** *President*
American Federation of Musicians

**TREASURER:**
**Rodney Bower,** *President*
International Federation of Professional and Technical Engineers

**DIRECTOR:**
**Jack Golodner**

## AFFILIATES:

**Actors Equity Association**

**American Federation of Government Employees**

**American Federation of Musicians**

**American Federation of State, County and Municipal Employees**

**American Federation of Teachers**

**American Federation of Television and Radio Artists**

**American Guild of Musical Artists**

**Association of Theatrical Press Agents and Managers**

**Brotherhood of Railway and Airline Clerks**

**Communications Workers of America**

**Federation of Professional Athletes**

**Insurance Workers International Union**

**International Alliance of Theatrical Stage Employes and Moving Picture Machine Operators**

**International Association of Machinists**

**International Brotherhood of Electrical Workers**

**International Chemical Workers Union**

**International Federation of Professional and Technical Engineers**

**International Union of Electrical Workers**

**International Union of Operating Engineers**

**National Association of Broadcast Employees and Technicians**

**Office and Professional Employees International Union**

**Retail, Wholesale and Department Store Union**

**Screen Actors Guild**

**Seafarers International Union**

**Service Employees International Union**

**United Association of Journeymen and Apprentices of the Plumbing and Pipe Fitting Industry**

**United Food and Commercial Workers International Union**

Mr. MILLER. Thank you.

On page 3 of your statement and earlier, you seemed to draw the conclusion that the basis for automation with respect to productivity is a trade-off with jobs, and you state that the result may well be a growing GNP coupled with high unemployment.

I wondered if you would expand on that because that is the scenario suggested many times by people involved in this area, that in fact you will have all of the benefits of increased productivity, increased markets and so forth, but you nevertheless will have a substantial unemployed population, and I suspect that the Government will have to figure out how to deal with it.

Mr. CHAMOT. At least the Government, in addition to other parties.

I do not pretend to know or predict the future, but this is a potential future we might have to live with, it seems, from the kind of technologies that are developing today. In the past, growing technologies which led to short-term displacements frequently did lead to a growing economy which ultimately generated more jobs, and provided a lot of additional job opportunities.

This may not happen in certain industries at least or across the board, if current trends are allowed to proceed with no checks at all. The reason for that is that the kind of technologies that we are talking about today are designed to eliminate people in many cases. They are not necessarily designed to eliminate them for any nefarious reason but it is simply an artifact of the highly automated systems that are being developed.

For example, if you develop an automated warehouse, you need fewer people to run it. Now, I don't think that the only advantages to the employer of an automated warehouse are that you would run with fewer people. You also have better inventory control, more efficient distribution of the goods in the warehouse, and so forth. There are lots of things that you could do automatically that you could not do before, much more up-to-date information, so that there are a lot of incentives for somebody who needs a warehouse to develop an automated warehouse.

The effect of that technology is to provide fewer jobs in the warehouse. The same thing is true of computer-automated, computer-assisted design for engineers, going to a completely different area, white collar professional employees.

An engineer's job is made more productive and more flexible by the use of computer-assisted systems, where they take over a lot of the drudgery that would have to otherwise be done in a slower fashion.

In the automobile industry several years ago it took something like 3 man-months to design a new steering column for an automobile and that same design job could now be done in 15 minutes using the computer-aided design systems.

Clearly, that is going to affect the need for engineers in the future.

You don't need as many engineers as you did before to do a lot of the routine work. Again, the benefits of the computer-aided design system go far beyond any thought of reducing numbers of people, and the development of these systems probably has not involved any thought toward reducing job opportunities in that field but

have instead been developed as part of the modern technology that is used today, but the effect, nevertheless, would be to reduce job opportunities.

Mr. MILLER. You seem to suggest that as automation spreads to different industries and different segments of the worker force within those various industries, the options of the displaced workers are going to be more and more limited. Is what you are saying?

Mr. CHAMOT. Yes.

Mr. MILLER. You can move from the banking to the insurance industry, but once they are both automated that option is somewhat limited, and then you can move to another service industry, but then your choice is also limited.

Mr. CHAMOT. The fact that it is going on across the board, that is one of the differences today. Every industry is being affected, every type of employee, white and blue collar, professional, service, clerical and you are right that unless things change we may well be faced with just that situation.

Mr. MILLER. And yet I would suspect that in my role as a person who participates in the making of policy, I would find the long-term implications of that rather troubling and difficult, because it is one thing to be unemployed with some prospect of either the economy will rebound or your job will rebound. It is another to simply not have a place in that economy for whatever reasons, either because of your initial training or the inability to obtain subsequent retraining. That is a far different social condition, or simply to continue some of the theories out about the future workplace, simply you are just not needed.

It is not a question of what skill you desire to possess, but it is simply the numbers, the availability of work against you.

Mr. CHAMOT. That is very true, but it is more than just a question of job versus no job. There are other mechanisms that we have to talk about.

When I was a little boy, my father used to work 6 days a week. I work five. That has happened across the board.

We have experienced in the course of our history as a nation a continuing reduction in work time from numbers of days worked per week to the number of hours worked in a day, increasing vacations, increasing numbers of holidays and so forth. That trend has brought us to the point where, with a vary large population using very advanced technologies, most people today work much, much shorter times than their fathers or grandfathers did.

We still have to talk and think about those sorts of things. Maybe we do have to work toward a 4-day week. Maybe we have to move toward more vacation time.

In Sweden, they legislate 5 or 6 weeks vacation for everyone in the work force. I am not suggesting that that is necessarily something we must do here or even that we should do it at the present time, but clearly there is a lot of room to move in those kinds of areas.

I think that unless the economy expands enormously rapidly, so that far more jobs are being created than is currently the case, we will have to look somewhat toward sharing the work. We have something on the order of 10 million people unemployed now. If

the economy starts to turn around tomorrow, it would take quite a while to get just those 10 million people put back to useful work.

Our population is also expanding and we are developing some of these labor-saving technologies. The job would not end with just putting those people back to work.

Mr. MILLER. Mr. Ratchford?

Mr. RATCHFORD. In listening to your statement and rereading it, I notice you concluded with a comment as follows: "It certainly means that there will be a great need for training and retraining programs (page 5) for protection of salaries and benefits as people are shifted into new positions, for real improvements in the quality of working life rather than having machines dominate the work environment. Above all, it will require a joint action on the part of all affected parties, government, business, labor and the community."

I would like to make the observation that in my 4 years in Congress, and in my 4 years as a member of this committee, that is one of the rare times where I have seen this issue of joint action on the part of those affected discussed.

If you could outline a short- and long-term agenda for this committee and for Congress, to begin focusing the spotlight on this issue, what would you suggest?

Mr. CHAMOT. I am afraid I could not hope to be so presumptuous as to lay out your entire agenda for you.

Mr. MILLER. Others have.

Mr. RATCHFORD. We do it for you all the time.

Mr. CHAMOT. We are used to that.

I would rather not talk too much about specifics because what you are embarking upon today with these hearings, and I presume that this is merely a first step, and that there will be many other activities, what we really need first is a delineation of all of the concerns of the various parties that are involved and the options that are available.

I might have some personal predeliction and there may well be others within the labor movement who would not place their priorities in the same order that I would.

Rather than talk about specific things you might do, I might mention some of the general areas to be looked at and one is certainly the area of training and retraining.

If we forget for a moment the question of whether or not there will be jobs, there is no question that there is going to be an enormous retraining and training requirement in the future in this country.

It already exists. There are some fields in which employers claim that they just simply cannot find enough skilled people. Where are the skilled people going to come from?

Some unions have attempted to fill the gap by modernizing their apprenticeship and training programs. The Machinists' Union—I understand you have a representative from that union who will speak later today—have been active in this area; the Communications Workers Union have been active in this area, but there is certainly a limit. Companies offer a lot of ad hoc job training when they cannot find people with the skills they require, but there is no national thrust today to training and retraining, no single entity

that is trying to check data as to what the job needs are today, what they will be in a few years, and what the skill requirements are going to be for those jobs.

Clearly something like that is needed and relatively soon. That would be only a first step. Having the data does not train anybody, it points you in the right direction.

I think that within the context of the United States, it probably would require a much expanded government effort. In some other countries, for example in Germany, it is sort of the tradition for major companies to provide training programs for new entrants into the workforce, even to the point where the assumption is made that many of these people will not work for that company, but it is a part of the company's social responsibility. We have nothing like that in this country, but we need some direction and focus in these areas and we need some money to fund this kind of an effort.

A lot of employers are reluctant to provide training in certain areas where there is a high demand for fear that the people who obtain that training are going to walk out the following week and get a job somewhere else and all of the money will be lost. That is a legitimate concern. It tends to hamper the development of on-the-job training programs.

Mr. RATCHFORD. One final question.

I know we have two more panels. We will have on the second panel a representative from a firm that has done exceedingly well in my part of the country, Unimation, Inc. They have been a major employer in Connecticut, and they are a leader in the world for robotics. That is the good news.

The impact of robotics on the labor force in an area such as Detroit certainly has meant eliminating a variety of those routine or hazardous jobs, in the name of efficiency and safety. However, what is the negative impart on the employee who filed those types of jobs? What can be done to offset this?

Mr. CHAMOT. The argument put forth by the proponents of robot technology in the early days was that these new types of equipment could be used to eliminate hazardous jobs, boring and routine jobs, and we would not disagree with that. We clearly are not in favor of people working in hazardous jobs. The problem is that the technology does not stop there. Anything that is routine can ultimately be automated.

Once the robot is in place, it stays there, so there is clearly a strong negative impact. I would guess my colleagues from the automobile industry would have lots of numbers to give you but there is a very high rate of unemployment in the automotive industry today and their feeling is that as the U.S. auto companies improve their situation and start to grow again, many of the jobs that were there before will not be there, that they will be permanently eliminated and taken over by robots.

I am not saying that that is necessarily a totally negative situation that we must fight. The labor movement in this country has not been uniformly negative on its approach to technological change which is necessary and has been going on for quite some time. The problem is how it is applied.

The workers who have been displaced by robots have diminishing options. There may not be very many jobs for them in the industry

from which they are displaced and their training may not be adequate for other jobs, and in today's economy, there are no jobs available.

The optimist in that issue would say ultimately the economy is going to expand because of the introduction of this technology, and a lot of new jobs will be created.

The big problem there is, one, will it actually occur, but two, when?

Certainly a human being who has been displaced from a job and is running out of support because the social support net has very big holes in it is going to be concerned if new jobs are going to develop 10 years down the road.

Mr. RATCHFORD. I thank you for your thoughtful comments.

Thank you.

Mr. MILLER. Thank you very much.

The next panel that the subcommittee will hear from is on the Office of the Future and the witnesses are Ms. Amy Wohl, Stan Schrager, and Judith Gregory, if they would come forward.

Welcome, and your prepared statements again will be placed in the record in their entirety, and the extent to which you can summarize it would be appreciated. We will go in the order in which you are listed.

Ms. Wohl.

## STATEMENT OF AMY WOHL, PRESIDENT, ADVANCED OFFICE CONCEPTS

Ms. WOHL. I am planning on making some informal remarks rather than a prepared statement.

I thought it might be useful to talk for just a moment about what the Office of the Future is. There is a lot of nonsense along the lines of science fiction movies about what the Office of the Future is going to be like. We do not have computers yet that you can talk to that will answer back, and we probably won't have them for another 25 to 50 years, given the current technology.

We don't have computers controlling what people do in offices. Computers do what they are told by people and not the other way around. What we do have is an enormous influx of computer technology that almost all at once has become useful to relatively untrained people who have very little knowledge of computer technology but who can actually use relatively sophisticated equipment. It is going to affect our entire society.

There are perhaps 50 million people today who are working in office jobs, and every single one of them will ultimately be affected by the change in the office workplace.

It is not going to happen slowly. There was a period of time, particularly in the late 1970's, during which it was predicted that office automation would proceed very slowly and that it would be a very orderly evolution. People would be largely unaffected by it except that their jobs would gradually change. I do not think that is true any more.

In the timeframe of 1987 to 1992, about one-half of the total office population will have been affected by the use of computer technology in offices. That is, their jobs will have changed signifi-

cantly and they will be interacting with some kind of a computer-based system much of the time.

I think that during that timeframe, that is, by the end of the next 10 years, nearly every large company in the United States will have been affected by the change in the way the office works.

Now, that means that there have to be effects on employment.

It is silly to think that all of these companies are going to go around installing office automation if in fact there is no cost-benefit to be gained from it.

The cost-benefit is sometimes stated in terms of the elimination of people, but it is more accurate to think of it in terms of adding fewer people over time. I have been doing consulting in the office for a period of about 8 years now. I have yet to see the first person whose job was actually eliminated, and who was fired or laid off as a result.

I have seen thousands of future job opportunities eliminated, however.

I think that it is useful to look at the effects on employment in a series of timeframes.

In the short term, there is really no effect on employment at all; that is, we are simply training people to use more sophisticated equipment, and we are not eliminating anyone or ready to hire fewer workers. In some medium-term sense, 2 to 5 years after a company begins to automate, we run into a whole set of problems, as major portions of the work force are affected by the process. During that medium term range, we start to see some employment displacement.

It is very funny for people in the information-processing industry to even think about employment displacement because we chronically work with the fact that we have too few people available rather than too many. There are probably 50 percent more jobs in the computer industry than employees and most of us go around constantly chasing scarce labor.

It is estimated that by 1985 there will be a shortage of 85,000 secretarial employees for secretarial jobs, so that in many cases we are not displacing real people from real jobs. We are substituting capital for labor which is in fact not available.

In the long term, clearly, as our previous witnesses indicated, we are going to have major social problems with the fact that there will in fact be fewer jobs after automation is completed or well underway than we would have without automation. This is going to call for changes in the infrastructure of the whole society, but that is not an office automation problem. That is a problem of automation on a more broad basis.

Certainly the office affects it, but it is not alone in creating or causing that problem.

In the meantime, we have something happening right in front of us that is going to have a profound effect on the rate at which office automation occurs, and that is the explosion in the personal computer industry.

Two weeks ago in Houston, Tex., an annual conference was held; 97,000 people attended that conference to look at computer systems. There were 64 personal computers on display on that exhibit floor. I would estimate that 50 of them did not exist 6 months ago.

We are looking at an absolute explosion in this industry. It will ultimately affect how people do things in the home as well, although that is rather far off.

Mr. MILLER. You are not suggesting 64 basically different models? There is some redundancy.

Ms. WOHL. Certainly they are very similar from a hardware and function point of view. There were 64 different companies and products in that category. They will vastly change the way we educate children from every level from kindergarten through college.

They will cause automation to occur in a very different way than was predicted.

When we looked at office automation as something that needed to be carefully controlled, or something that required very expensive specially designed work stations, it was clear that the progress would be slow and that the rate of job displacement would be controllable.

When you look at the cost availability and ease of use of these new personal computing products, it is clear that the rate at which they will be installed and used in American business is going to progress much more quickly than any of us had dreamed.

We are looking at clients in major firms who are ordering thousands of units of personal computers for delivery in the next 12 months. That cannot occur without affecting the way in which people work in their offices. It is not going to be a bumpless kind of thing. In order for these computers to be successfully installed in the home, in schools, and in the workplace, it is going to require a tremendous change in computer literacy in our society. We are already watching that change occur.

It is a requirement, not something that we can avoid. If you think that it is not, in fact, going to take place, observe someone's granny going up to a bank teller machine and talking to the computer to get $50 out. That is a perfect computer interface, because if you use it successfully, it gives you money. It is harder to teach people to use a computer interface that has less positive results associated with it.

We have people who play with the computer games in the arcade.

Mr. RATCHFORD. I have three of them—sons.

Ms. WOHL. It is clear it is possible to design computer interfaces so people enthusiastically adopt them. We are going to get much better at that in the future. The size of the requirement demands that that take place.

If you have 50 million people to train, the training process has to be made very painless.

On the other hand, we have not done a very good job at encouraging the formal progress of computer literacy, because a lot of it has taken place informally through market forces. They are wonderful but we could use some help in this area to encourage the development in industry, both in the user part of the industry and in the vendor, provider part of the computer industry. That can be encouraged through changes in the tax laws.

There is a bill currently before the House asking that computers be handled differently in terms of charitable donations to educational institutions than other items are handled. That might make

vastly more computers available for educational use. One could also encourage employers to provide computers for home or educational use to their employees, thereby speeding up the pace at which computer literacy would take place. The Federal Government can adopt other policies to encourage computer literacy.

All of these things are going to happen in any case, but the Government can choose to speed up the process rather than slowing it down, and that might be something that should be encouraged.

In closing, I would like to comment on the fact that I am always amused by people who think that it is possible to stop the clock. This movement pervades society and has nearly forever. It is a historical inevitability for a technology once its time has come, and it is clear that in the United States—and in fact in all of the developed countries in 1982 and through the rest of the decade—the time has come for the computer to be used broadly in society rather than narrowly in small rooms. Therefore, it is time for our Government and for the leaders in our society to encourage the smooth spread of this new technology through the society rather than trying to prevent it from occurring.

I will be happy to entertain any questions you might have.

Mr. MILLER. Thank you.

## STATEMENT OF STAN SCHRAGER, VICE PRESIDENT, CHASE MANHATTAN BANK

Mr. SCHRAGER. I would like to read my prepared statement and then answer any questions the committee may have.

I guess the best way to characterize the present labor situation, in terms of the people shortage in the data processing field today, is that you're lucky if you break even. And the future seems to hold more of the same.

Compared to human resources, availability of other resources such as physical space, equipment, and finances can be greatly influenced by management decision. The availability of systems human resources is governed almost exclusively by supply and demand, and the ability to retain these scarce resources through good management practices.

The demand for data processing personnel today in all industry is considered to be 50 percent understaffed. And staffing needs are expected to continue to rise sharply in the future. Through multiple surveys taken among various corporations, staffing requirements were up 16 percent in 1981 over 1980, and projected to go up 23 percent in 1982. By 1990, only 8 years away, the projected increase is 140 to 180 percent.

The supply of systems talent comes from three primary sources: The mid-career, experienced individuals who are obviously in the greatest demand.

A second source is the retraining of individuals who are currently in other careers or related careers.

And last, the campus, which for most other occupations tends to be the primary source of new talent, in this industry it is not. Only 20 percent of the current opportunities are filled from the campus.

The computer science curriculums today tend to be scientifically oriented as opposed to training graduates in business applications.

The schools are also facing the same problems as industry in finding talent, and very often cannot compete with industry in keeping this talent, nor can they compete with industry in technological advances. Because of this, no real increase of supply from this source is projected in the near future.

In order to try and make the campus graduates more acceptable to management, extensive internal training programs are offered by many corporations. Usually these training programs are also used, as I have already mentioned, to retrain current employees who are in other occupations less attractive than data processing.

At Chase Manhattan Bank, we run an 18-month entry level program which includes both formal classroom instruction and on-the-job learning experiences. The participants are trained on one of four different pieces of equipment, IBM, Wang, Datapoint, or DEC, depending on their assignment. We have been averaging 60 graduates a year. But again I must emphasize that though our efforts in this area are increasing, the demand/supply ratio of seasoned talent is of great concern.

And the seasoned talent, besides not being available, is becoming increasingly expensive. Salaries have increased for experienced individuals by 12 percent, on average, from 1980 to 1981. They are expected to increase another 14 to 16 percent in 1981. By 1990, the $100,000 nonmanagerial technician will not be considered extraordinary.

What is the cause of all this demand? To use Chase Manhattan Bank as an example, it is difficult to identify a business activity within the bank that is not currently, or in the near future will not be impacted by data processing. As a lending institution, as a financial information transfer agent, we need technology. Management relies on technology for management information and to respond to customer needs. Our customers want information and service which is quick, of high quality, easy to access, and customized to their requirements.

So far I have addressed how the increasing reliance on technology has impacted our human resources from a technical viewpoint. But technology has matured to the point of being much closer to the end user, meeting the specialized requirements of business, and directly impacting the work environment of the non-EDP professional.

The introduction of micro computers has closed the gap between machines and office workers. With the development of a tiny chip of silicone called a microprocessor, the price of technology dipped sharply, and computers, with as many applications as the human imagination could conceive, came out of the back rooms, into the office, and onto our desks.

Today there is an endless range of possibilities available for gathering, storing, and retrieving information. And Chase is positioning itself for tremendous growth in these areas.

From the corporation's viewpoint, overall office automation strategies must be developed and implemented in order to avoid confusion, duplication, and the possibility that various systems will be put in place that are not compatible, potentially causing the office staff to use incompatible systems to get their overall job accomplished. From the individual's viewpoint, this technology creates in

the workplace a revolution in modern office management, and the future holds increased opportunities for those in the white collar work force.

Currently, three out of five employed Americans are engaged in some kind of information handling or service job, and the ranks are rapidly increasing. By the end of the present decade, office workers in the industrial world will outnumber farmers and laborers combined.

These new legions represent a major transformation from an industrial to an information oriented society. But though our economy is becoming more dependent on the information services sector, investment in American office workers has been lagging.

Business managers today feel compelled to seek out new methods to meet future needs. For the most part, however, offices are still organized in much the same way they were 100 years ago, when telephones and typewriters were first introduced. Although many businesses purchase the latest in automated office equipment, too often management methods remain rooted in preautomation techniques due to their lack of training in the potential uses of the technology at hand.

Management has weathered its share of thorny learning problems. In the early stages of the technological revolution, giant computers made little impact on the typical office—or office worker. These huge black boxes were generally located in temperature and dust controlled back rooms, delicately tended by technical specialists who operated and serviced them.

Now that technology is in the open, and office automation is offering significant opportunities for change, training programs must be put into place to prepare this office population and help the transition work smoothly.

Today, technical training programs at Chase exists not only for the technical staff, but also for the nontechnical managers, clerks, and secretaries.

Other implications created by the proliferation of these small systems are data security, job design, the physical environment, and other related human factors caused by the changing workplace. Supervisory training is required to make our managers aware of the importance of these implications, and to prepare them to deal with issues that might arise.

We in industry have come a long way in our use of technology. During the 1960's and early 1970's, automation was viewed as a way to reduce staff. And during those years large production shops did have many people displaced by technology. Much of that type of work in the service industry has been accomplished and few opportunities to do more of the same in the future exist.

In the mid-1970's, technology was viewed as a way of transferring information quickly and accurately, both internally to its employees and externally to its customers. Automation also began to be used as a means of providing different types of customer services; for example, in banking, the automatic teller machine, home banking, or automated cash management. Today, while we continue to look for creative uses of technology from our technical staff to support the basic requirements, the business manager who is

being brought closer to technology can have a greater influence on its uses right in his or her own office.

The next step is the attempt to connect all our uses of technology so that our technological business requirements are met through a single integrated systems architecture.

Thank you.

Mr. MILLER. Thank you.

## STATEMENT OF JUDITH GREGORY, RESEARCH DIRECTOR, WORKING WOMEN EDUCATION FUND

Ms. GREGORY. I am very happy to be here today to present testimony on behalf of the working women education fund and 9 to 5, the National Association of Working Women, which is an organization representing some 10,000 women office workers across the country dedicated to improving working conditions and gaining recognition and respect for women office workers in the work force today.

In April 1980, 9 to 5, then known as Working Women National Association of Workers, released a report called Race Against Time, Automation of the Office, the first report in this country to discuss the problems of office computerization from the clerical workers' viewpoint.

We state our contention that innovations in office technology have a vast potential to upgrade office jobs, upgrade skills and upgrade pay, and to provide more avenues for job satisfaction for clericals.

But we also present a sharp critique of the rampant problems we found facing women office workers: deskilling, devaluating and degrading of jobs, a decline in promotional opportunities rather than an increase, potential for large-scale job loss in the not so distant future and increased health risks.

It helps to recognize the context that these problems come in, to know just a few things about the clerical work force today.

Nearly one in five of all U.S. workers work in clerical jobs today, the largest single occupational category.

The jobs are 80 percent women, comprised of women and among the lowest paid in society despite their central economic role.

The average pay for women clericals working a full year hovers at around $11,000 a year, and age, race, and sex discrimination is widespread and an undervaluation of work is as well.

It is estimated in comparable work studies, for example, secretaries are undervalued by an average of 40 percent.

It is also the faster growing large occupational group in the work force, and the BLS predicts clerical jobs will account for nearly one in four of new jobs created in this decade; so it is in this context that the problems and potentials of office automation technology come in.

I am here to describe our concerns—our concerns about computer technology from the viewpoint of those at the bottom of the office hierarchy. As one data entry clerk told us, I have been doing this job for 10 years, and I have been tired for 10 years. It is the monotony that does it. I would like to know what it feels like not to be tired.

Another expresses the feelings of many: "I feel like saying to my boss, what do you think I am, an extension of the machine?"

I think that you cannot solve problems unless you face them squarely, and, today, I want to focus on five dangers posed by computer technology, not deliberately, but problems that are occurring in the practices as they continue now without conscious interventions.

I want to discuss five dangers for office workers and for society as a whole.

First, the danger of structural unemployment in the not so distant future; second, the danger of increased sex, race and age discrimination in a polarized work force, and, third, the danger of degradation of working conditions and increased job stress and occupational health problems related to video display terminal work, and, fourth, the danger of runaway office work and the dilemma of office homework, both related to an increased office mobility resulting from the interconnection of telecommunications and microprocessor technologies and the danger in office and service sectors, of decreased productivity, decreased efficiency, and the declines in the quality of services for the general public.

The issue of unemployment has received a great deal of attention this morning. It is a problem staring us in the face. In office jobs there is still very rapid growth in the jobs. We feel that that growth in clerical jobs will continue certainly for the next decade and probably for the next two decades, and we hope even farther, but we also feel that some of that growth masks the labor reducing tendency of computer technology, so, for example, you have a slower rate in employment growth in what have been some of the mainstays of the new service economy.

In banking—employment in banking is still expanding. The rate of job growth from 1968 to 1975 was 4.5 percent annually, while the volume of transactions in banking was approximately 8 percent annually during that time period.

From 1973 to 1976, as a result of increasing uses of computer technologies in banking, the rate of job growth slowed to 3.2 percent a year while the volume of transactions continued to climb steadily.

The finance industries are growth industries, whereas other employment sectors lack similar advantage.

There is also an ever greater need for more jobs, not fewer. For women workers the figures are startling. While a record 12 million women entered the work force in the 1970's, an even greater number will seek work, an additional 6.5 million women in this decade.

The effects of office automation on employment, we feel, will occur more slowly in the United States in the office areas than the predictions in European countries and neighboring Canada, but we do think a drmatic loss in the jobs is possible in 10 to 15 years, and that we must begin examining public policy issues now.

To say we have 10 or 15 years to come to grips with the implications of the structural unemployment in the economy as a whole is to say we do not have very much time.

The second issue I want to bring to you today is the danger of increased sex, race and age discrimination in a polarized work

force, and, by that, I mean that yes, there is expansion of better and more highly technical jobs at the upper levels, but there is an even more rapid expansion of semiskilled and more deskilled jobs at the base of what makes office automation technologies work, the very rapid consistent accurate data entry word and data processing which were at the bottom.

There is concern expressed more and more over a skills gap between these two levels that becomes harder and harder to bridge.

I will give you a description of this changing structure of office employment from a manager who told writer Barbara Garson, in his words:

> We are moving from the pyramid structure of office employment to the Mae West. The employment chart of the future will still show swellings of good jobs at the top, and we'll never completely get rid of those big bulges of clerks on the bottom. What we're trying to do right now is pull in that waistline:

And, by that, he is referring to secretarial jobs which are the highest status and highest paid in the clerical field and middle and lower management jobs which have provided mobility for many workers.

For minority workers, we feel they are especially vulnerable because of their concentration for women minority workers in back office data entry pools often involving shift work and in positions such as keypunching, which have been identified by the BLS as a declining occupation.

There are approximately a quarter million keypunchers today, whereas the clerical workforce is 12 percent minority in general, keypunchers 20 percent occupied by black women, typically older women who have stayed in their jobs longer and in that sense have had slightly higher wages.

This is clearly a group that is an ideal target for job retraining efforts in the next 10-year period, and that identification of what skills to train people for is a key factor, but also protecting and having concern in this case for minority and older women workers.

Older women clericals also face problems as their jobs undergo technological change, and there is a notion that older workers don't want to learn new things. It is a prevalent stereotype. The problem is the exclusion of older workers from on-the-job training programs as we found in a study of 1980.

Just some things that women told us: They don't want to waste training on an older person, one said. While a 49-year-old woman who talked to us while looking for a new job had this to say: First it started out as a rumor that half of us were going to be replaced by new word processors and CRT machines. Well, within a month they had laid off me and four other girls, all of us with some number of years in toward our pensions, and now they have two kids right out of high school running those machines.

The older employees could have been trained and in this case had expressed interest in being trained on those new machines. Instead, they were laid off.

The third danger is that of degradation of work conditions, increased occupational health risks and increased job stress.

By degradation I am referring to problems such as deskilling, devaluing and undervaluing of office work, office speedups and the health issues. In sociologist Roslyn Feldberg's and Evelyn Glenn's

sociological study of five large New England employers, they found that when computerization came in, the proportion of low-level clerical jobs remained the same, and clericals were rarely upgraded to fill new jobs. The automated clerical jobs were more mechanical and narrow and that the main avenues for clerical workers were either horizontal or downward, but not up.

We often hear that it is only the boring jobs which are eliminated by office automation. A recent study by Dr. Mary Murphree, of Columbia University of New York, which shows how the jobs of Wall Street legal secretaries, the highest respected in the field, were adversely affected.

The skills were gradually split, the skills from those jobs, and left the secretaries in insecure positions with the sensation that they were merely "telephone gatekeepers."

Devaluing of office work, the majority of women workers are working harder and faster often for more people at once without getting paid more. Many of the new skills are undervalued and often not recognized yet.

Word processing, here in the Federal sector, there is a forthcoming article in the Federal Labor Relations Journal that cites the downgrading of word processors in the Federal employment system as a classic example of how compensation did not keep pace with the new skills required to adapt to technological changes.

There is also, in this case, the jobs were downgraded, and it is being challenged. There was recently an arbitration case brought by one of the white collar unions in Oregon that challenged the lower grading of word processing and gained wage increases for workers in those jobs.

Some people see that word processing jobs represent a natural link between clerical jobs and computer programming, something that is not completely recognized as yet, the ability of word processors to communicate with a machine in a way that moves them along that path of computer literacy that Amy Wohl was discussing.

For the health problems, an important study by the National institute of Occupational Safety and Health found that higher levels of job stress among VDT workers and in strictly clerical workers than among any other job category of workers, but that study had another finding which is important.

That is, they compared clerical VDT operators with conventional clerical workers doing the same work with typewriters and pen and pencil, and professionals using VDT's, and in this case editors and journalists, and the research team found the highest stress was among the VDT clericals followed by the conventional clericals with the least job stress reported by the professional VDT users, and they attribute this to differences in working conditions, degree of decisionmaking and control over the workpace and work task, the use of skills and satisfaction and rewards for the job done.

This finding underscores our view that it is not the technology per se that causes workers problems, but rather how it is used and how workers are able or forced to use these new systems.

The fourth danger that I mentioned is that of runaway offices and the dilemma of office homework. We are seeing a new level of office mobility and parallel problems.

We are beginning to see more movement of office jobs, particularly in the clerical and from region to region and competition between the States which can trigger a competitive chain reaction similar to that which developed, or that helped speed up the movement of manufacturing across State lines.

The offshore office is a new phenomenon that has been described in the press recently. One entrepreneur in New York, the change there is that this can be done via satellite connections. Previously, the work was done offshore, but with satellite technology it makes this a more viable and potentially more widespread problem, and we think a danger. This entrepreneur pays his data entry workers in Barbados an average of $1.50 per hour, and told Business Week, "We can do the work in Barbados for less than it costs us to rent floor space in New York. The economics are so compelling, a company could take a whole building in Hartford, Conn., and transfer a whole building to India or Pakistan."

"Office homework" poses a dilemma for policies to protect workers from unfair labor practices while allowing flexibility for workers who might not otherwise be able to work. We believe there are positive and negative aspects involved in this problematic trend.

Still in a very experimental stage, it is unclear how big a trend "telecommuting" might become for clerical workers. It is certainly a possibility which should be monitored and analyzed carefully, and an area where effective public policy needs to be developed. Experts quoted in Business Week recently predict that as many as 15 million workers could be earning their primary income from so-called homework by the mid-1990's.

The implications of electronic homework will be very different for workers in different positions of power and prestige. The history of subcontracted homework for lower level workers is one of employers taking advantages of isolated workers through decreasing piece-rates, reduced benefits, and evasion of labor laws.

Office homework is often touted as an easy solution for the critical shortage of childcare for working parents with small children. I hear this everywhere I go.

There was a study by Margaret Olson. Olson found increased stress among office homeworkers with families, especially women. In fact, it is not a solution to childcare at all; women who can afford to, will have a babysitter in the home while she is working, or will take the child to daycare if available. The notion that mothers can just sit at a terminal and take care of children at the same time just does not match what women do or want to do for their children.

Yet, given the choice of no work or working at home, virtually all the women with small children in Olson's study said they would choose to keep working. In our opinion, this is an area where regulation is going to be needed, and it should be very thoughtfully considered.

The fifth danger that I cite is that in the office and service sectors, there is a danger of decreased productivity and efficiency due to excessive managerial control techniques, not necessary components of the technology, but becoming more widespread.

Studies on stress, automation, and health show that error rates increase anywhere from 40 percent to 400 percent when the control

over the pace of work is taken away from workers and given over to a machine-controlled system. Constant computerized monitoring of individual work performance, the use of prompter devices, and automatic call distributors are creating the electronic equivalent of the moving assembly line, which some researchers believe will have worse effects on error rates and workers' well-being than the notoriously alienating industrial assembly line.

Some excessive forms of control systems are counter-productive as well as harmful to one's health. An office worker told Harvard Business School Prof. Shoshanah Zuboff:

> When a person makes a mistake with a computer, to try and get that mistake corrected is so much redtape. So you tend to let it go. Maybe when they see how bad the information is, they'll give us back our jobs.

On that, I want to summarize that we must face the danger that the future could be worse than the present, and that it will only be better if we make it so through conscious efforts. We firmly believe that each of these dangers can be turned on its head and transformed into an opportunity to address the problems of today's work force and truly improve the work force of tomorrow.

The flexibility and versatility of computer technology makes it uniquely possible to create better and more integrated jobs, better working conditions, better uses of human resources, unprecedented chances to address and reduce discrimination by designing training programs for computer literacy using occupational bridging techniques to avoid that impassable skills gap and the ability to provide improved and more widely available services and, through that, we hope, increased employment wherever possible by implementing new technologies with social criteria in mind, and we believe that there is a critical role for public policy in this regard.

I have submitted to the committee a number of recommendations for your consideration, which we see as first steps. Some of them simple steps, and some of them more complicated; but I think it is important to reiterate the magnitude and urgency of the problems that we face tomorrow and the ones we will face tomorrow, I think, we will all agree—and it has been raised in this panel that these changes are occurring very rapidly—that in the next 10 years, 5 to 10 years, we will see patterns of office automation locked into place. The major companies, the trend-setters invest in a major way and set those trends, and unless we take action today, the negative trends and problems can be frozen into place.

As a society, we believe we are in a critical time in the 1980's to influence office automation while the technology is still in flux. We believe that we are in a race against time to avoid these dangers and that the clock is ticking.

Thank you.

[Prepared statement of Judith Gregory follows:]

PREPARED STATEMENT OF JUDITH GREGORY, RESEARCH DIRECTOR, WORKING WOMEN EDUCATION FUND, 9 TO 5, NATIONAL ASSOCIATION OF WORKING WOMEN

The coming of the "Office of the Future" and the growing use of microcomputers has become one of the most frequently discussed and debated topics in contemporary society. The use of computer technology in offices has grown explosively in recent years. In 1979, researchers at Stanford University estimated that 1.5 million of the nation's 3.5 million offices were large enough for some form of office automation (Uhlig, R. et al, Office of the Future, 1979). Industry experts estimate that

seven to ten million U.S. workers now use video display terminals (VDTs or CRTs), the key units of office automation, in their jobs. These devices barely existed a decade ago. As microcomputers continue to decrease in cost and increase in power, a greater number of small- and medium-sized businesses will be able to afford automated office systems.

The growing market for automated equipment is reflected by spectacular rates of growth in the computer industry. The market for word processing, for example, is expected to grow at a rate of 500 percent during the five-year period from 1978 (when it was worth $780 million) to 1984 (when it is expected to yield $4.2 billion in revenues), according to Fortune magazine (December 3, 1979). The overall office automation market—including data processing, electronic mail, high-speed copiers and other more exotic equipment—netted $4 billion in revenues in 1980; it is expected to increase at an annual rate of 40–45 percent through 1985. Office automation, as Time (November 23, 1981) put it, now "dwarfs almost every other sector of U.S. business."

### THE DRAMATIC IMPACT ON JOBS

The widespread introduction of office automation is creating profound changes in the nature of office work. "We are on the brink of a second industrial revolution which will eliminate drudgery and boredom once and for all," business periodicals proclaim. The technological revolution "is creating more stimulating careers for office workers," a writer rejoiced in a special feature of U.S. News and World Report (September 18, 1978).

Examined more closely, however, American management's idea of the "office of the future" means little more than a recreation of the factory of the past. Today's office workers find themselves threatened with many of the same processes of "job degradation" which undermined the skills and dignity of an earlier generation of industrial workers. Without conscious and concerted interventions by concerned policy-makers and employers, labor unions and office workers themselves, we risk society-wide dangers, and we will lose important opportunities to use new technology to address age-old problems which plague women's work today, problems of low pay, job segregation, dead-end jobs and discriminatory employment practices.

Office automation can and should be used to enhance jobs; provide chances for advancement for women clericals; increase productivity; provide a healthier work environment; and improve our standard of living. But, as automation is being implemented today, the opposite is occurring for the majority of women in the office.

### THE CLERICAL WORK FORCE TODAY

Women office workers are on the front line of the new wave of automation. Clerical employment is the largest single category of the workforce in the U.S., accounting for nearly one in five of all employed workers. The Department of Labor predicts that clerical work will be the fastest-growing major occupational group in the 1980s. And it is also an increasingly female work force—in 1950, women comprised 62 percent of all clerical workers and by 1980, fully 80 percent. Of the 45.5 million women working in the U.S. today, 35 percent are employed in clerical jobs. The occupations especially targeted for computerization—file clerks, bookkeepers, secretaries, typists, bank tellers and various finance and insurance industry jobs—are all at least 90 percent women. Despite their crucial role in the economy, the average pay for clericals hovers around $11,000 a year.

We believe that you cannot solve problems unless you face them squarely. We see the issues raised by office automation differently from the glowing images many optimistic business proponents paint, because our organization, 9 to 5, National Association of Working Women, represents clerical women. I am here to describe our concerns about computer technology from the viewpoint of those at the bottom of the office hierarchy.

"I've been doing this job for 10 years and I've been tired for 10 years. It's the monotony that does it. I'd like to know what it feels like not to be tired," says a 31-year-old data entry clerk for a Midwest utility company.

"I feel like saying to my boss, 'What do you think I am—an extension of this machine?' " a Boston office worker cries out in frustration.

"Now they have a new set-up called the 'open office' where I work," a woman who works at a terminal all day for a New York newspaper explains. "There are panels six feet high around all the operators. We're divided into work groups of four to six with a supervisor for each work group. In many cases, we don't see another person all day except for a 10-minute coffee break and lunchtime. All we see is the walls around us and sometimes the supervisor. The isolation is terrible."

These experiences are the daily reality for nearly 20 percent of the nation's laborforce. A secretary at a Cleveland accounting firm in a prestigious downtown office told 9 to 5: "I've been here almost a year and I've got seniority among the secretaries. Emily and two of her co-workers experience almost daily headaches, nervous stomachs and shaky hands. They're upset that another one of the secretaries, who has high blood pressure, was recently sent to the hospital for tests. They feel their employers just don't care: "The place looks gorgeous, and that's where the management's priorities lie. They're not really as interested in efficiency as they are in using people up and pushing them out the back door."

In April, 1980, 9 to 5 (then "Working Women, National Association of Office Workers") released "Race Against Time: Automation of the Office," the first report in this country to discuss the problems of office computerization from the clerical worker's viewpoint. In the report, we state our contention that innovations in new office technology have a vast potential to upgrade office jobs, skills and pay, and to provide more avenues for job satisfaction for clericals. We present a sharp critique of the rampant problems we found: deskilling, devaluing, and degrading of women office workers' jobs, a decline in promotional opportunities, potential for large-scale job loss, and increased health risks. (I will provide the committee members with copies of the report.)

Today, I will focus on five major societal problems posed by the introduction of computer and telecommunications technologies.

### THE COMPUTER AGE CONFRONTS SOCIETY WITH FIVE GREAT DANGERS

The "Computer Age" confronts society with five grave dangers:

The danger of structural unemployment in the not-so-distant future.

The danger of increased sex, race and age discrimination in a polarized workforce.

The danger of degradation of working conditions and increased job stress and occupational health hazards in the office.

The danger of unaway offices and the dilemma of "office homework" as a new level of "office mobility" is achieved.

The danger, in the office and services sectors, of decreased productivity, decreased efficiency, and declines in both the quality and accessbility of services for the general public.

### 1. THE SPECTRE OF STRUCTURAL UNEMPLOYMENT

The dynamic of computer technology is against job creation in any sector where it is applied—it is a labor-reducing technology. It already takes fewer people to do the same or greater volume of work. The International Federation of Clerical, Executive and Technical Employees (FIET) predicts that for white collar employment, "there is likely to be a cumulative employment impact hitting one sector at a time but building up over a ten year period." A 1978 study for the Organization for Economic Cooperation and Development, reported in the New York Times, warned: "The evidence we have is suggesting increasingly that the employment displacement effects of automation anticipated in the 1950's are now beginning to arrive."

A French study for the Ministry of Industry predicts 30 percent reductions among clericals employed in the finance industries by 1990 (Nora, S. and A. Minc, "Computerizing Society," MIT Press, Cambridge, 1980).

In the United States, clerical work is still expanding explosively—the U.S. Department of Labor estimates that there will be 4.6 million new jobs for clerical workers, nearly one in four of all new job creation in this decade. the continued need for clerical workers appears to be "masking" the potential job-displacing effects of automation in office industries such as insurance and banking. While employment in banking is still expanding, for example, the rate of job growth slowed from 4.5 percent annually from 1960 to 1973, to 3.2 percent a year from 1973 to 1976, while the volume of transactions continued to climb steadily. The finance industries are "growth" industries, while other employment sectors lack similar advantage. In fact, today there is higher unemployment among white collar and clerical workers than any time since the post-war years after World War II, yet another sign of the far-reaching effects of the recession. And there is an ever greater need for more jobs, not fewer. For women workers, the figures are startling. While a record 12 million women entered the workforce in the 1970s, an ever greater number will seek work—an additional 16.5 million women—in the 1980s (Business Week, March 15, 1982).

The effects of office automation on employment may occur more slowly in the U.S. than in some European countries or neighboring Canada, but a dramatic loss in jobs is very possible in the next 10 to 15 years. We must begin developing public

policy on these issues now. Because computer technology affects both blue-collar and white-collar jobs, we are faced with the disturbing question: where will new jobs be created at all in our economy of the future?

### 2. THE DANGER OF INCREASED SEX, RACE AND AGE DISCRIMINATION IN A POLARIZED WORK FORCE

There is increasing concern over the danger of "polarization" of the office employment structure, with an increased but still small number of highly technical jobs at the uppermost level and a large number of deskilled jobs at the base, with a "skills gap" between them that becomes harder and harder to bridge (Menzies, H. "Women and the Chip," Institute for Research on Public Policy, Montreal, 1981. See also: Driscoll, J. W., "Office Automation: The Dynamics of a Technological Boondoggle," Sloan School of Management, MIT, March 1981). The result is a new version of the "internal dual labor market" that translates into more sex segregation for women office workers. Office automation relies on a base of data-entry and data-processing jobs which involve repetitive, standardized, fast-pace and accurate work. By homogenizing many different clerical functions into information-processing at display terminals, jobs become more interchangeable. The characteristics of secondary labor market jobs—low wage, low-benefit, high turnover, non-union, insecure and semi-skilled jobs—are extended to the office.

A manager described the changing structure of office employment quite boldly to writer Barbara Garson ("The electronic Sweatshop: Scanning the Office of the Future," "Mother Jones", July 1981, pages 32-41): "We are moving from the pyraid structure of office employment to the Mae West," he said. "The employment chart of the future will still show those swellings (of good jobs) on the top, and we'll never completely get rid of those big bulges of clerks on the bottom. What we're trying to do right now is pull in that waistline (expensive middle management and skilled secretaries)."

In an assessment of word processing vendors' claims compared to users' experiences and research findings, Dr. Leslie Schneider of the Institute for Industrial Social Research, University of Trondheim, concludes: "The possibility of 'new and more stimulating careers' with word processing will be limited to a few super secretaries at the top and not to the majority of clericals . . . Most clericals will probably end up with the same or more routine jobs unless there is a planned effort to improve their work," (Schneider, L., "Words, Words, Only Words: How word processing vendors sell their wares in Norway," IFIM, Trondheim, 1982).

"Sex, Race and Age Discrimination Continue," and are not only perpetuated but are often made more intense.

The explosive growth of computer-related occupations ushered in with the office automation revolution represent an unprecedented opportunity to address the long-standing problem of sex and race segregation in the office work face. The Bureau of Labor Statistics projects that approximately 685,000 new jobs will be created in the 1980's—an increase of 47 percent by 1990 (BLS, USDL, "Employment Trends in the Computer Field," 1981). These jobs include: computer operators, computer technicians, computer programmers, systems analysts, data base managers and other information specialists and computer specialists. Some observers estimate that the need for programmers is already 40 percent greater than the current supply (See Jobin, J., Women's Day, 1981)

While women have made progress in entering computer fields (women comprise 29 percent of computer programmers and 22 percent of systems analysts, according to 1980 BLS statistics), researchers find persistant disparity in placement and wages of women compared to men (Dubnoff, S., "Women in Computer Programming: Do They Get an Even Break?", Center for Survey Research, Boston, 1979, for example). Women are underrepresented in the better programming and specialists' jobs; they are concentrated overwhelmingly in the lower ranks of computer jobs. While 78 percent of the women in computer occupations work either as keypunchers or computer operators, only 31 percent of men in computer jobs are in these positions. In fact, computer operations has recently become "feminized," shifting from 44 percent women in 1975 to 60 percent women in 1980. Pay increases declined in these job categories during the same period.

The participation rate of women predictably decreases as one climbs up the office computer-related job ladder: over 95 percent of keypunch operators are women, 62 percent of computer operators, and 75 percent of office machine operators are women; only 26 percent of the higher-paid computer specialists are women.

Minority women are especially concentrated in "back-office" data entry pools, often involving shiftwork. A recent examination of trends in job segregation by race

and sex by Julianne Malveaux points out that the clerical jobs that black women dominate—postal clerks, telephone operators, keypunchers, duplicating machine operators—have a "behind the scenes" character to them (Malveaux, J., "Recent trends in occupational segregation by race and sex." Paper presented at the Workshop on Job Segregation by Sex, National Academy of Sciences, Washington, D.C., May, 1982). Many of these jobs are the special targets of office automation. There are about a quarter million keypunchers today, for example, some 20 percent of whom are black and other minority women. Keypunchers are typically older and have longer job tenure than the average clerical worker. These workers are particularly vulnerable—keypunching is an occupation expected to decline in the next 10 years (according to Department of Labor predictions), and should be targetted for meaningful job retraining efforts.

Older women clerical workers also face exacerbated problems as their jobs undergo technological change. The notion that "older workers don't want to learn new things" is a prevalent stereotype. In our view, the problem is exclusion of older workers from on the job training programs, as we found in our study, "Vanished Dreams: Age Discrimination and the Older Woman Worker" (Working Women Education Fund, 1980). Some of the experiences older women office workers told us include:

"They don't want to 'waste' training on an older person."

"I told them so many times that I wanted to be trained in data-entry when the program began," said one frustrated 59-year-old woman. "Instead they hired two young men off the street in their 20's, and had the nerve to ask me to train one of them to be my supervisor after he went through the data-entry course."

A 49-year-old woman who talked to us during a lunch-break from job hunting said, "First it started out as a rumor—that half of us were going to be replaced by new word processors and CRT machines. Well, within a month they had laid off me and four other girls, all of us with some number of years in towards our pension. Now they have two kids right out of high school running those machines." Rather than the "two kids," the older employees could have been trained to run the new machines. Instead, they were laid off.

### 3. DANGER OF DEGRADATION OF WORKING CONDITIONS AND INCREASED OCCUPATIONAL HEALTH RISKS, ESPECIALLY INCREASED JOB STRESS

Let me take you into the world of the automated office by telling you just one woman's story:

"Rose reentered the workforce after 20 years away. Her excellent typing skills quickly landed her a job as one of 12 CRT operators in a downtown Cleveland publishing company. She found that office work had changed a great deal during her years away from the workforce. 'The chairs were good and the machines adjustable, too. But I have never been confined to one place doing key entry at such a pace.' She explains, 'The computer at one end of the room keeps track of the keystrokes you do. The more key strokes, the more money you might get. At the end of the day, the figures are posted. You look at your speed, you look at everyone else's and you say, 'Tomorrow I'm going to do better.' They get you thinking just like they want to, you're really pushing hard."

Rose's situation may sound extreme, but not really. The underlying principles are more and more widespread. Constant computerized monitoring of individual workers' speed and volume of work is used to establish a median "quota" or "average" for the "output" required of each employee. the workload demanded is then continuously revised upward. Typically, workers in the lower third by speed or volume are pressured to meet the "average." Once they've done so, the "average" then becomes the "minimum" acceptable level and the pressure to increase speed and workload begins again. Failure to meet the "quota" or "average" can result in disciplinary action or loss of one's job; other workers will leave "voluntarily" if the pace is unbearable. Such systems will make speed-ups a way of life in the office if unchallenged.

Problems which threaten to degrade office working conditions for the majority of clerical workers include: problem of deskilling, devaluing of office work, and increased health risks related to poor machine design, workstation design and poor job design.

*Problems of deskilling.*—While office automation has improved jobs for some, the majority of women office workers' jobs are more closely supervised and increasingly "specialized"—meaning that each person performs ever smaller fractions of the larger task. When this happens, each job requires less training and offers less chance for advancement. When new computer systems are introduced, certain skills

may be made obsolete (while new skills are belittled and unrewarded) and variety is lost from the work. The problems of "deskilling" can occur in a variety of ways.

"In the midwest headquarters of a multinational corporation, secretarial jobs were broken down into component parts when work-processing equipment was brought into the department. As a result, one woman does electronic filing all day, another extracts data all day, one answers phones all day, another handles correspondence all day, and so on. The company requires that each woman do a 'tour of duty' of several months in each subtask in order to be considered for promotion. In other words, each woman must be promoted four times to get back where she started. This is one example of how companies use the power of new office technology to wipe the slate clean and start over with new rules."

Clerical jobs are becoming more dead-end, as career paths are disrupted, and altered for the worse more often than not. Sociologists Roslyn Feldberg and Evelyn Glenn found in a 1977 study of five large empolyers in New England that when computerization was introduced, the proportion of low-level clerical jobs remained the same, and that clericals were rarely upgraded to fill new skilled jobs. The study found that the automated clerical jobs were more mechanical and narrow, and that "the main avenues for clerical workers are either horizontal or downward," but not up (Feldberg, R., and E. Glenn, Social Problems 25, October 1977, pages 52-64. Also, work in progress, discussions with authors).

We often hear that "it's only the boring jobs" which are eliminated by automation, that new office technology "will eliminate boredom and drudgery once and for all," and the new jobs will be more interesting and stimulating. These are among the most common myths about computer technology.

A recent study of Wall Street legal secretaries' jobs shows how these highly skilled and high-prestige jobs were adversely affected, leading to demoralization, job dissatisfaction and job insecurity among the women (Murphree, Mary, "Rationalization and Satisfaction in Clerical Work: A Case Study of Wall Street Legal Secretaries," Ph. D. Thesis, Columbia University, N.Y., 1981). Dr. Murphee found that: "while early form of office computerization served to upgrade and assist secretarial worklives . . . current innovations are striking at the heart of the traditional legal secretarial craft and creating a number of serious problems . . . the most challenging and responsible tasks traditionally in the legal secretarial domain are gradually being transferred away from the secretarial to cadres of professional and para-professional workers such as para-legal assistants, librarians, accountants, personnel specialists and word-processing proof-readers, thereby reducing the secretarial function to one of merely 'telephone gatekeeper.'"

A 1980 study in a Swedish insurance company found that 100 percent of the VDT operators felt there was no decrease in the number of routine tasks, the mental strain, or demand for attention since the introduction of the VDTs (Johansson, G., and Aronsson, G., 1980, Stress reactions in computerized administrative work, Stockholm, Sweden). A team of researchers from the National institute for Occupational Safety and health (NIOSH) conducted a field study on VDT workers in 1980. They observe that: "Clerical VDT workers' jobs are akin to machine-paced assembly lines in manufacturing plants in the sense that they involve minimal control over tasks or workplace, boring, repetitive tasks, work overload, close monitoring by supervisors, and fear of being downgraded or replaced by the VDT . . . . Computerization processes designed to simplify work in order to increases "thru-put" without concern for human elements turn such offices into clerical assembly lines akin to industrial, mechanized, paced assembly line." (B.G.F. Cohen, M.J. Smith and L.W. Stammerjohn, Jr., "Psychosocial factors contributing to job stress of clerical VDT operators," in "Machine-Pacing and Occupational Stress," Taylor & Francis, Ltd., London, 1981).

Devaluing and under-valuing of office work. For the majority of women office workers, office automation means working harder and faster, for more people at once, without getting paid better. Fulltime VDT operators in 1979 made only $7 more a week than conventional typists, despite claims by computer vendors that productivity soars from 50 to 500 percent depending on the nature of the work. In the banking and insurance industries (among the most computer-intensive) wages for clericals are 8 percent to 19 percent below already low national averages by occupation according to the U.S. Department of Labor.

Office workers also find that their new skills are undervalued and often go unrewarded. Employers underestimate the skills of experienced word processing operators, for example. Some experts believe that word-processing may provide a natural "step" to computer programming if the relationships between the different skills are understood. According to Linda Taylor, President of the Association for Women in Computing, women doing word processing "know the conventions of program-

ming, how to communicate with and instruct a machine, how to store and retrieve data. That is only a step away from COBOL programming—and not a major step."

An article on prospects for pay equity in federal employment gives an example of how adaptation to new technology is not carefully considered in job evaluation systems. Lyne Revo-Cohen calls the case of federal word processors "a classic example of how compensation has not kept pace with new skills required to master technological changes." She writes that: "When the government re-audited jobs of clericals using word processing equipment, the job classification was lowered. Word processors were informed that because their jobs required more than 75 percent typing, and because the end product of their work was a typed manuscript, the job series will top out at GS 4. This contrary to the fact that the job had become more technical, complicated, demanding and productive. The impact on morale and turnover has been highly negative and costly. Another option might have been to take the job out of the clerk-typist category, reclassify it as "video-text operator," and build in a broadened career ladder "(Revo-Cohen, L. "Federal Service Labor Relations Review," spring, 1982, forthcoming).

Increased health risks associated with work at VDTs and related especially to the organization of work in automated offices are discussed in Working Women's report, "Warning: Health Hazards for Office Workers" (April, 1981, Cleveland).

Research is beginning to uncover a virtual epidemic of stress symptoms and stress-related disease among office workers. Millions of workers are affected. And the symptoms do not disappear at the end of the work day. Millions of families may also be affected by the problems caused by office job stress.

A 1979-80 study by the National Institute of Occupational Safety and Health (NIOSH) found alarming levels of stress among women video-display-terminal operators a Blue Shield's San Francisco offices. In fact, the study found the clearical VDT operators showed higher strees ratings than any other group of workers NIOSH has every studied, including air traffic controllers. Eighty to ninety percent experienced eye strain or muscle strain. High levels of anxiety, depression, and fatigue were reported (Smith, M.J. et al, NIOSH, "Potential Health Hazards of Video Display Terminals," Cincinnati, June 1981).

Findings from the Framingham Heart Study released in February of 1980 showed that women clerical workers developed coronary heart disease (CHD)—clearly identified as a stress-related disease—at almost twice the rate of other women workers. Women clerical workers with children and married to blue collar husbands developed CHD at nearly twice the rate of all men workers (Haynes, S. and M. Feinleib, American Journal of Public Health Vol. 70, No. 2, February, 1980).

Through automation, the enjoyable aspects of clerical work—variety, contact with other people, natural rest breaks and changes in routine—are threatened with elimination. The most stressful aspects—repetitive tasks, constant sitting, dead-end jobs, isolation, a relentlessly fast work pace—are on the rise.

An estimated five to ten million video-display terminals, (VDTs) were in use in 1977. The long-term health effects of sitting before a flickering screen for eight hours a day will take years to determine. The short-term effects, however, are already clear: eye strain, headache, back, neck, and shoulder pain, fatigue, nausea, digestive problems, short-term loss of visual clarity and temporary changes in color perception (See Warning. . . ., WWEF, 1981). While some new models of VDTs are designed for better safety, they account for only a fraction of machines in use.

Many of the health problems associated with VDTs are related to psychosocial factors. In the NIOSH study, when clerical VDT operators were compared with "conventional clericals" and professionals using VDTs, the researchers found that: "The pattern emerging from the results clearly indicates that the clerical VDT operators report the highest stress level, the professional operators report the least amount and the clerical workers who do not use VDTs fall in between. This suggests VDT use is not the only contributor to job-stress elevation: job content must also be a contributor" (NIOSH, 1981). There were vast differences between the VDT clericals and VDT professionals in working conditions: the degree of decision-making, control over workpace and job tasks, use of skills, and satisfaction and rewards for the work done.

This finding underscores our view that it's not the technology per se which causes these problems, but rather how the technology is used by management, and how workers are allowed to, or forced to, use it.

4. THE DANGER OF RUNAWAY OFFICES AND THE DILEMMA OF OFFICE HOMEWORK

The combination of telecommunications and microprocessor technologies makes it possible for office work to be geographically dispersed and reorganized, as a new level of "office mobility" is achieved.

*Runaway office work.*—We are beginning to see more movement of office jobs, particularly by the clerical-intensive finance industries. Citibank, for example, moved its credit card operation to South Dakota because the state has no ceilings on the maximum interest rates which can be charged for credit transactions. Delaware loosened its banking laws in 1981, thus attracting credit and lending offices of ten of the nation's biggest banks (U.S. News & World Report, February 2, 1982). Other states (and banks) are expected to follow suit. This can trigger a competitive chain reaction similar to that which has developed over tax incentives to business in the manufacturing sector.

The "offshore office" provides another parallel to the experience of runaway factory jobs. A certain amount of bulk information-processing work has been performed outside of the country for some time. In the past, this work was shipped to and from offshore location by plane but can now be done via satellite by entrepeneurs like George R. Simpson of New York-based Satellite Data Corporation, recently interviewed in Business Week (March 15, 1982). Mr. Simpson's company relays printed materials by satellite to Barbados where it is done by data entry clerks earning an average hourly wage of $1.50. In Simpson's words: "We can do the work in Barbados for less that it costs in New York to pay for floor space . . . The economics are so compelling (that a company) could take a whole building in Hartford, Connecticut, and transfer the whole function to India or Pakistan."

"Office homework" poses a dilemma for policies to protect workers from unfair labor practices while allowing flexibility for workers who might not otherwise be able to work. We believe there are positive and negative aspects involved in ths problemmatic trend.

Still in a very experimental stage, it is unclear how big a trend "telecommuting" might become for clerical workers. It is certainly a possibility which should be monitored and analyzed carefully, and an area where effective public policy needs to be developed. Experts quoted in Business Week recently (May 3, 1982) predict that as many as 15 million workers could be earning their primary income from so-called homework by the mid 1990's.

The implications of electronic homework will be very different for workers in different positions of power and prestige. For professionals and executives, having a computer at home is highly convenient and gives greater flexibility, whereas for clericals such as data entry workers the work will be monitored and paid under piece-rates in electronic homework situations. The history of subcontracted homework for lower-level workers is one of employers taking advantages of isolated workers through decreasing piece-rates, reduced benefits, and evasion of labor laws.

A thoughtful assessment of the social questions involved in the "telecommuting" trend is provided by Professor Margrethe Olson of New York University (Olson, CAIS Working Paper #25, N.Y.U., 1981).

Office homework is often touted as an easy solution for the critical shortage of childcare for working parents with small children. Yet Olson found increased stress among office homeworkers with families, especially women. In fact, it is not a solution to childcare at all—women who can afford to will have a babysitter in the home while she is working, or will take the child to daycare if available. The notion that mothers can just sit at a terminal and take care of children at the same time just doesn't match what women do or want to do for their children. Yet, given the choice of no work or working at home, virtually all the women with small children in Olson's study said they would choose to keep working.

Olson found that individuals who are successful at homework tend to be withdrawn from social and community life. If one has children, the ability to "discipline" one's family is an important factor in working at home successfully.

In 9 to 5's opinion, Olson's findings suggest that those who could benefit most—lower-income mothers of small children—are not necessarily the workers management will consider for employment first or even at all. Work in the home is not the answer to the lack of childcare facilities—women still desire and need daycare centers or babysitters to care for children while they work, whether they are at home or in an office, and need the wages to afford to.

5. THE DANGER IN THE OFFICE AND SERVICE SECTORS, OF DECREASED PRODUCTIVITY AND EFFICIENCY, AND DECLINES IN THE QUALITY AND ACCESSIBILITY OF SERVICES FOR THE GENERAL PUBLIC

Studies on stress, automation and health show that error rates increase anywhere from 40 percent to 400 percent when the control over the pace of work is taken away from workers and given over to a machine-controlled system. Constant computerized monitoring of individual work performance, the use of prompter devices, and automatic call distributors are creating the electronic equivalent of the moving assembly line, which some researchers believe will have worse effects on error rates and workers' well-being than the notoriously alienating industrial assembly line.

In other words rigidly computer-controlled office work systems are counter-productive as well as harmful to one's health. A study by NIOSH finds that both job satisfaction and performance improved when operators controlled their own work pace (Cohen, 1980).

An office worker told Harvard Business School Professor Shoshanah Zuboff:

"When a person makes a mistake with a computer, to try and get that mistake corrected is so much red tape. So you tend to let it go. Maybe when they see how bad the information is, they'll give us back our jobs."

SUMMARY

Altogether, we must face the danger that the future could be worse than the present—and that it will only be better if we make it better through conscious efforts.

We firmly believe that each of these dangers can be turned on its head and transformed into an opportunity to address problems of today's workforce and the workforce of tomorrow. The flexibility and versatility of computer technology makes it uniquely possible to create better jobs, better working conditions, better uses of human resources, unprecedented chances for advancement to address and reduce discrimination by designing training programs which provide for "occupational bridging," the ability to provide improved services and more widely available services, and to provide increased employment by implementing new technologies with social criteria in mind.

We believe there is a critical role for public policy, for the development of interventions which will prevent the problems posed by computer technology in the American workplace, and help release its potential benefits for all office workers. 9 to 5's recommendations represent first steps in this process.

Action by the Congress is urgently needed for several reasons: 1) Employers do not willingly take actions needed to protect office workers' health and well-being; 2) More than 90 percent of all U.S. private sector clerical workers, and more than 80 percent of public sector clericals, lack union representation and therefore do not have access to collective bargaining as an avenue to improve working conditions and challenge unfair management practices; and 3) Office automation is being introduced so rapidly that action must be taken now before irreparable harm is done to office workers' jobs, health and quality of working life.

We must recognize the magnitude and urgency of the dangers we face. Computer consultants predict that in 2 to 5 years we may have a "frozen technology"—adverse effects will be frozen into place.

We as a society are in a critical time in the 1980's to influence office automation while the technology is still in flux. We are in a race against time to avoid these dangers, and the clock is ticking.

Thank you very much.

RECOMMENDATIONS FOR ACTION ON OFFICE TECHNOLOGY, 9 TO 5, NATIONAL ASSOCIATION OF WORKING WOMEN

(1) Ensure all U.S. workers certain basic rights in relation to new technologies, to include: The right to advance information about plans for new computer systems before decisions are made; the right to relevant training and education during working hours, with employers providing "release time" with pay; the right to participate in systems design, and the right to funding support to choose technical consultants of their own; the right to have "technology representatives" chosen by workers, who receive special training needed to represent workers' interests and concerns about new systems; and a protected right to refuse to work with new computer-based systems if they have not been consulted, if workers; concerns have not been met, and if employers are abusing new technology in ways which devalue, deskill or degrade jobs, adversely affect health of otherwise undermine working conditions.

(2) Act to protect the occupational health & well-being of office workers by adopting proposed Norwegian regulations limiting work at video display terminals (VDTs) to 50 percent of the working day, in order to promote good job design,

(3) Adopt the following measures for al public sector clerical workers using VDTs (CRTs), to serve as a model for private sector employers: the proposed Norwegian regulations on work organization in VDT work; the National Institute for Occupational Safety & Health (NIOSH) general recommendations to reduce potential health risks of VDT work, including provisions for rest breaks (15 minutes per 2 hour of visually intense, high workload and/or highly repetitive VDT work); and guidelines for VDT machine design features, adopted by the state of Wisconsin for purchase bids of new equipment,

(4) Restrict computerized monitoring of individual work performance, or other methods of computer-controlled pacing and measurement of work, as an invasion of workers' right to privacy.

(5) Provide funding support for training initiatives on new technology, targeting funds for programs which will benefit those most in need, such as: Women and minority workers; older displaced workers and re-entry workers; unemployed youth; and the technologically unemployed.

Funds should be targeted for industries where computer technology is being introduced rapidly.

(6) Conduct studies to assess the impact of computer technology in key industries such as insurance and banking, with special attention to such issues as: the effects of automation on pay scale, job descriptions, and promotional opportunities for women and minority workers already concentrated at the low end of the pay scale; particular impacts on long-term and older employees; impact on turnover rates; impact on incidence of involuntary part-time, shiftwork and piece-rate work; potential employment displacement effects; and effects of centralization, monitoring and machine-pacing of work.

(7) Conduct a study to assess the practices and responsibilities of the computer industry.

(8) Review the state educational system, its programs and capabilities, in light of the impacts of computer technology.

(9) Survey labor organizations to identify problems of their members, their concerns and suggestions for solutions to problems of new technology.

New office technology should mean: Use of more skills, not fewer skills on the job; more control over the pace and organization of work, not less control; more decision-making, not less; and increased productivity should be compensated by: increased pay; more breaktime; and/or reduction in weekly hours without a reduction in pay or a combination of all of the above.

Mr. MILLER. The clock is also ticking for us. We are going to have to break and go vote.

If you can, if your schedule will allow it, I would appreciate it if you could stay and respond to questions that we might have.

We should be back within 20 minutes.

[Brief recess.]

Mr. MILLER. The subcommittee will reconvene.

I want to thank you very much for your presentations, and you have raised a number of different issues as to the different points of view as to the impacts of automation, and those will specifically be addressed in the future hearings.

Let me ask you, I have some concerns, not concerns, but I guess I am having trouble grasping in an industry such as yours, in the banking industry, this idea of continued employment expansion and paralleled and continued expansion of automation within that industry, and I just—I am not quite sure how I understand how the two come about together, and I say that when I look at an industry that in many areas is now cross-pollinating with other parts of the financial industry, brokerages and banks which are starting to look a lot more alike and consumer services, and I guess my question is, does this start to top out at some point as the banking, financial

industries consolidate, whether it consolidates into brokerage houses or banks or into both.

Keypunch operators, well, at some point your informational base has the ability to update itself.

Mr. SCHRAGER. We would no longer be looking for keypunch operators, but other types of skills.

It is true that banks are finding themselves in competition with companies other than banks.

What we have found, though, is that the difference in our competitive stance is the diverse types of service we can offer our customers.

That is in terms of both quality and timeliness, and much of those kinds of services, almost entirely, are systems services as opposed to the old type of banking services such as lending.

Right now, in terms of different types of products that we are getting involved in, they are basically data processing-oriented types of services.

Mr. MILLER. You talk about the problem of reaching a point where you have a fully integrated system that is compatible, at least across your company, and I assume other companies in this field which are looking for the same basis, whether they are an energy company, or a financial company.

I speak as a layperson; that that suggests that you will be able to offer a wider range of services with fewer people offering those services, and if that is true, that is inconsistent with this parallel growth pattern.

Mr. SCHRAGER. Fewer types of devices, not necessarily people.

We are looking to create a strategy which would allow us to integrate the various types of systems that we put in place.

What we have now is, as was mentioned in one of the earlier testimonies, the number of different vendors that are producing equipment, and the number of different vendors that are producing software.

Not all of this equipment and software is compatible, and if individual departments within an organization are allowed to go ahead and develop their own system strategies, they may not, be able to be integrated at some point in time, which may lead an individual, a manager, a secretary, or clerk finding himself or herself sitting in front of multiple terminals in order to do one piece of the individual's job responsibilities.

Mr. MILLER. Would it be fair to predict in 5 or 10 years' time, if that arises, that will be smoothed out within that process, to achieve the efficiencies and integration that you desire? That may happen as you have this immediate short-term buildup in automation, but over the long run that, too, will be integrated.

Mr. SCHRAGER. It is somewhat dependent on the different types of creative services that can be provided by both the computer industry and by the individuals who are using the system's activities.

We are getting into activities now, such as things like home banking, which is still very much in its early stages.

Two years ago, it probably won't have even been highly considered as a viable product to offer our customers.

That could lead into other kinds of activities which may, in fact, produce new kinds of software, new kinds of hardware, to provide

more creative kinds of services. All needing people to develop and maintain these systems activities.

Mr. MILLER. Any other comments?

Ms. WOHL. I think it is true to say that we are moving toward the design and implementation of systems which require fewer intermediaries.

What that really means is that in the long run, as Judy mentioned, you are going to flatten the corporate pyramid. There will be fewer people in the middle and at the bottom, in fact, because you are not going to require the same number of specialists whose job is to use the machine on behalf of the person who will recieve the end result.

Rather, the process of using the machine will become so refined and so easy; so much of it will be done automatically, that you will, in fact, require fewer people as intermediaries to use the machine on your behalf. That clearly has implications in terms of employment displacement unless the economy is growing very rapidly. There is no question that there is an implication there.

Mr. MILLER. Judy, any comment?

Ms. GREGORY. Well, I think that there are a couple of things.

The kind of thing that Amy Wohl described raises a couple of questions, and one is, who has access to those new more integrated jobs, and, again, I would restate the concern that minority, women, and older workers not be left behind when newer, better jobs are created, and the connection with education and who gets what kind of education is an important connection that I think this committee can pursue, so that, for example, I know people who are sending their children to computer literacy courses at the age of 10, but those are as yet private courses, and you get that repetition of a theme of a polarization of the society there; that some people will be able to afford to become computer-literate more rapidly than others, and it will widen the gulf for those who remain behind.

Second, in the area of what kinds of services are provided, again we are seeing services created and provided for an elite. You look at computer data bases in public library systems as an example; that those are services where the library pays a fee to have the service and people pay a fee to use the service, and it defies in the conscience of many librarians; it defies their notion of the public service role of libraries and starts to splinter that kind of thing; so thinking thoughtfully about what kind of services we want, what the quality of services would be in the public and private sector is one way to mitigate the employment effects.

A second effort that is needed is those kinds of technical systems, how they are created in relation to the good middle-level jobs that do exist and to protect those jobs through proper job design and innovation.

There was a study done by Elinor Winn, who testified to the National Academy of Sciences sometime last year, and she looked at the work done by clerical workers, and she found it was problem-solving work.

It is interdependent on different employees, not parallel in that way to some kinds of production work, and she proposed that technology be designed to continue that kind of problem-solving activity, that kind of social interaction of those work groups, but she con-

cludes by saying that a lot of the efforts in the computer industry are to design systems to eliminate workers, and I think that needs to be challenged at that level of innovation.

Mr. MILLER. Mr. Ratchford?

Mr. RATCHFORD. I am going to refrain, and I would like to ask questions, but I fear in the next hour we are going to be called to the floor, and knowing we have another panel, I will simply reserve my questions.

Mr. MILLER. Let me restate the fact that you have raised a whole range of issues from whether or not you are only going to get 20 percent of your workforce off the campus, to whether or not you have the ability to do internal retraining within the industry, to the speed of which we expect this to take place in the office, and finally to a number of very disturbing issues of whether the offshore office, which, I think, has tremendous potential. I was recently in Haiti, where I saw an offshore assembly operation, with very much the same potential as you have described with integrated efforts, as we now see in the automobile industry. Components can be made in a number of different areas of the world, so that never again are you vulnerable to a long-term workstoppage in any single plant, because that body part or engine part, or whatever, can simply be brought in from another area where that is not subject to us.

So you have laid out a host of issues that we will continue to address as we become more and more specific with respect to the impact of automation, and I appreciate your time, staying with us so long this morning.

Thank you very much.

We will go ahead and run the film, which takes about 7 minutes here. Feel free to come stand behind the projector or move where you can see it here.

Mr. Munson, you are going to narrate this.

**STATEMENT OF GEORGE MUNSON, VICE PRESIDENT, UNIMATION, INC.**

Mr. MUNSON. There is sound, but I reduced a longer film into some clips that I thought would be most appropriate for this morning, and the sound would come out a little garbled.

Mr. RATCHFORD. Let me extend your invitation, when your schedule permits, to come to Connecticut to see firsthand what we are going to witness in this film, because this company is one of the miracles of technology.

It certainly is something that western Connecticut takes great pride in, and it also raises the whole issue of what price progress. In western Connecticut, this company is a major new employer, and we are pleased for that. We also know, however that in Detroit, it may raise other issues.

Mr. MILLER. Let me say that I don't know how all of western Connecticut feels, but this guy has been bending my ear about you for a while.

If we can have the lights, we will go ahead here.

Mr. MUNSON. What you are going to see are some short clips, of various types of industrial robots in their environment; very briefly and hopefully, it will dispel the usual image of the R2D2.

This is a press-loading application. There are a series of five robots transporting very large automotive parts from one press to another, and this was formerly done by human operators.

You can see the difficulty. Forging, diecasting, foundry work, all of these are very hazardous and undesirable environments.

It is more so perhaps than glassmaking.

This is making funnels for television tubes, and, as you can well imagine, it is a very, very hot environment. It is also a very demanding one, because glass flows continuously, and the work must be done.

A similar application to diecasting is injection molding: This machine is unloading plastic parts from two large machines, again a very hazardous occupation, because people have indeed got caught, either limbs or their whole body, between those platens with 2,500 tons of closing force.

This relates somewhat to our aerospace industry, because it shows routing on a panel for a F-16, but very typical of that kind of job in industry.

Another one in which productivity has been improved and scrap rates reduced dramatically is investment casting.

Scrap rates as high as 85 percent have been reduced to 5 percent or less with robots.

Arc welding is another area that is a tremendous potential for the robot. There are literally hundreds of thousands of human operators with a productivity that is perhaps 30 percent related to 90 percent for the robot.

This application is one of those plastic parts you saw being removed from the injection loading machine, a TV cabinet, and another class of robot is striping the decorative front of the panel.

By the way, that robot is a rather sophisticated and highly intelligent machine, but it finds application in a rather mundane applications here, handling speaker magnets for automobiles, but a part that is very susceptible to damage, so quality is an important issue.

This is a very interesting application because the robot, in fact, is not working very hard, but it has increased the productivity out of that $250,000 milling machine by 400 percent. This is part of what robots are all about, the increase in utilization of high-cost capital equipment.

This is a deburring operation being performed by the robot; now on arc welding on automobile bodies; a rather new area of wire harness making. Looking at some of the more advanced systems, this illustrates the ability of the robot to see, as well as coordinate, its motion with two moving conveyors.

The parts are coming randomly down a conveyor and looked at by a camera and the intelligence is transferred into the robot's program to instruct it on what the orientation of a part is so that it can now place these parts in a regular fashion.

This is just one illustration of the kind of thing it can do with the more intelligent robots.

This, is the application that has received the most publicity—automobile spot welding.

I think that will do it.

Mr. MILLER. We are going to run over and vote, and we will be right back.

[Recess for Members to vote.]

AFTERNOON SESSION

Mr. MILLER. Mr. Munson, since you started off this panel, why don't you go ahead, and if you have prepared remarks that you would like to make, or we will put your statement in the record.

Mr. MUNSON. I do have a few remarks, Mr. Chairman. I do have a statement that I wish to have put in the record. In that statement, what I tried to do was to position where our industrial base in this country stands. And some of my colleagues here earlier today did a fine job of that, I think.

If we do not take advantage of the technologies that are available to us, and in fact, the ones that we have developed, which we tend to export, then we will continue to be low man on the totem pole in productivity.

So I would address these primary issues. First of all, in the area of technology, improved manufacturing methods are essential to sustained economic growth. I state this as a flat position that I think anybody who realizes what is happening in the world marketplace would agree with.

Technical innovation creates new industries and it does create new and more jobs. I suspect even in its present infant state, the robotic industry probably is responsible for at least 10,000 jobs that didn't exist before.

And, of course, competitiveness, and I am talking about competitiveness within the country, and worldwide, does require continual modernization. In my brief that I submitted, I pointed out some of the areas in which we are grossly deficient in the way in which we operate our factories, particularly as compared to some of our foreign trading partners, but I won't go into all those details right now.

A lot of reference is made, including the title to this hearing, about the second industrial revolution, and I think that that is a fair appraisal of our current situation.

But I would like to say that in regard to robots themselves, the industrial robot, it is just one of many technologies that are driving this industrial revolution. The robot does not stand alone as an entity which is going to see its full fruition without the combination of computer-aided engineering, computer-aided design, computer-aided manufacturing, automatic warehousing, automatic assembly, all of these things are essential and part of the second industrial revolution in which, I do believe, that the robot and the computer, as it relates to the intelligence of the robot, is an integrator, very definitely.

I would also say that our—certainly our productivity history in the last decade has put us in a very unfavorable position in world markets. We are not competitive, and if manufacturing does occur offshore, and perhaps we do assembly work here, things of that sort, it is because we have not maintained the modernization of our industrial base, and therefore, have not been competitive at all.

Now, I also would like to put in context the fact that the robot is not only a part of the whole scene as far as other technologies are concerned, but it is, indeed, a subclass of automation, the first vestiges of which we saw, in the 1920's when Henry Ford put together the assembly line.

That was mechanization, it was not truly automation. Automation didn't come until maybe 15 years later. But the interesting thing about it, is that the creation of that method of manufacturing—and it has been historically so—through the first industrial revolution and all through the decades up until this time, is that improved methodology in manufacturing has raised our affluency. Certainly there have been times of labor displacement, times that affluency has not always been passed on to the people that are producing the products. But in time, it happens.

The other thing that I would address to, is of course what you saw in the film certainly illustrates that there are many jobs that robots do, that remove the human worker from very undesirable environments.

That is not always going to be so, there will be applications in the future for robots where the jobs aren't particularly undesirable. But unless we do something to improve the quality of product, as well as the productivity picture, then again, we are not going to be competitive in the world marketplace.

Finally, I would like to address to something that you heard over and over again, and that is that in any event, robots or whatever other technologies are being placed in our factories of today, there is an absolute need for a new look at training.

Referring to the last paragraph of my brief, the real issue regarding the blue-collar workers and the technologically advancing economy is training. But we do well not to think only in terms of robotics, but in terms of our entire computer-driven world, and the sophisticated machines it has generated.

Skilled technicians, programers, and engineers of all kinds are needed. New programs are required to develop the require curricula, particularly at the vocational school level.

And subsidies or tax breaks should be considered for in-plant, on-the-job training, as well as company-supported outside programs.

We have neglected this urgent need. If we continue to do so, it will not be robots that take jobs, it will be our competitors.

Thank you, sir.

[Prepared statement of George Munson follows:]

PREPARED STATEMENT OF GEORGE E. MUNSON, VICE PRESIDENT, MARKETING, UNIMATION, INC., DANBURY, CONN.

I. INTRODUCTION

Ever since the invention of the wheel, man has sought to ease his burdens through the development and use of mechanical devices and aids in the manufacturer of goods-goods that would protect him in his environment, improve his comfort and health and generally improve his standard of living.

As his inventive genius progressed and the population grew, pressures to produce more of these goods increased, as did the individual's desire for them and his earning power to procure them. Thus was born the first Industrial Revolution.

Initially, and for many years the fruits of the factory workers' labor accrued mainly to the affluent. But, little by little, as methods and machinery improved, so too did the lot of the average worker.

And so has it alqays been with the advancement of Technology.

In 1870, our's was an agrarian society with 47 percent of our population engaged in producing food for domestic consumption. Today, less then 3 percent of the population is so engaged, producing surpluses which are exported in vast quantities.

In the 1920's, mechnaizaiton in the workplace took a giant step forward when Henry Ford introduced the assembly line to automobile manufacturing.

The increase in productivity which resulted put the automobile within the reach of many more people and our affluency broadened.

World War III placed a different kind of pressure on our industrial complex but out of it grew a capability to produce manufactured products in quantities theretofore unheard of—the Age of AUTOMATION had arrived.

Since then, automation has become the foundation upon which the economy has grown. Through its advances, our standard of living has dramatically increased and new industries have flourished. Millions of new jobs have been created; at the same time the industrial workers' lot has vastly improved.

Today, the pressures for continued advancement remain essentially as always:

1. International technological competition.
2. Demand for higher living standards.
3. Population growth.
4. Cost levels to hold or expand markets.
5. Product quality and uniformity demands.
6. Competitive business.
7. Expanding horizons of manufacturing knowledge.

An important factor in business, obviously, is profits. Profits and cost go hand in hand. In the long run, to have profit leadership it is necessary to have cost leadership; to get cost leadership, we must have manufacturing innovations.

## II. TECHNOLOGICAL INNOVATIONS

There is no doubt that micro-electronics is one of the most, if not the most, dramatic and vital technical development produced. The technology itself is mindboggling but, more importantly, it is an essential tool. It's ability to process data of all kinds in vast quanitities and at unimaginable speed is the keystone to advanced manufacturing systems, automated systems, and terrestrial and extra-terrestrial exploration. Yet, from a manufacturing standpoint, it is just one of the many technologies that must be fully exploited if we are to advance our economy and regain our competitive position. Some of these technologies are:

1. Computer aided engineering.
2. Computer aided design.
3. Computer aided manufacturing-NC, CNC, DNC.
4. Group technology.
5. Automatic warehousing.
6. Automatic assembly.
7. Robotics.

We have these technologies. In fact, in most cases we have developed them. But, we have not exploited them; we have not created a business atmosphere (of risk taking) to do so. Unfortunately, many of our world trading partners have and are.

It is essential that we do. Quoting Peter Drucker.

"The only way for a developed economy like the United States' to regain its international competitiveness is to encourage a fairly rapid shrinkage of traditional blue collar employment. Future competitive plans will operate with computer controlled robots. Workers will not operate machines but program computers or whole plants".

While this may seem like strong medicine, the alternatives are worse (e.g. trends in our current economy). Let's look at some random facts:

1. The average age of U.S. manufacturing equipment is about 20 years; in Japan it is under 10 years: Result—Breakdowns are excessive and advanced technologies cannot be applied.

2. Seventy-five percent of all parts manufactured in the U.S. are in lots of 50 pieces or less. In other words, in spite of the numbers we hear from the automotive industry, the vast majority of manufactured goods are processed in small batches: Result—factory managers are overwhelmed by impossible logistics without adequate information systems and controls.

3. In metal cutting 95 percent of the total time a part is in process is spent in quenue or being moved around; only 5 percent of the time is spent actually making chips or adding value in the usual sense: Result—archaic factory arrangements and material flow depress productivity.

4. High cost capital equipment is utilized or available for use less than 70 percent of the time; usually because of the vagaries of the human operator but often because of poor scheduling, bottlenecks and downtime for servicing or repair: Result—low return on investment inhibiting modernization and growth.

5. Quality is sacrificed to quantity; few incentives are created among the workers to produce quality and monthly shipment quotas override all other considerations: Result—warranty costs increase and in some cases, loses to product liability suits insue.

6. Shop floor inventories are huge due to poor management of work flow and in spite of this, material is often not where it should be when it is needed. Management is by crisis and the banks get rich on the interest paid on short term debt due to these unnecesary stock piles: Result—costs soar, competitiveness diminishes.

7. Inefficient and excess material handling gobbles up time, creates chaos on the shop floor: Result—process flow and control is lost.

8. Response to change and the ability to process small batches is virtually nonexistent: Result—business is lost and prices are excessive.

9. Product design does not take into consideration manufacturability; design variations create unmanageable manufacturing logistics: Result:—opportunities for reduced costs, higher profit and quality are limited.

The bottom line is that unless we rationalize our manufacturing processes anew (re-industrialization), dynamically utilizing technological innovation we will be unable to respond to changing markets and we will not be competitive.

### III. ROBOTICS

The foregoing attempts to convey three primary points:

1. Improved manufacturing methods are essential to sustain economic growth.
2. Technological innovation creates new industries and new (more) jobs.
3. Competitiveness requires continual modernization.

With these factors in mind, then, consider robotics. Robotics is a (relatively) new technology that is essential to the automated factory. It is, in fact, a sub-class of automation but with attributes uniquely suited to needs in the modern factory.

First, it is flexible automation. That is, it is capable of performing a variety of tasks, often times in hostile environments.

Second, it is series produced and, therefore, is cost effective and of proven reliability and long life.

Third, it is adaptable to changing conditions, therefore, it is suited to batch manufacturing and does not become obsolete with product changes.

Fourth, it is tireless and consistent and, therefore, its output is predictable and of high quality.

Fifth, its intelligence (though moronic) permits it to "speak" with other factory machines and computers.

Industrial robots (as defined by the Robot Institute of America) are use most commonly in: (1) Spot welding automobile bodies and parts; (2) Loading and unloading machine tools, die cast machines, presses etc: (3) Material handling and palletizing in diverse industries such as pharmaceuticals, cosmetics, metal working, food; (4) Forge shops and foundries; (5) Assembly work; (6) Electrical and electronics fabrication; and (7) Arc welded fabrications; and many more.

In most cases today, robots are cost justified on the basis of displaced labor.

Many of today's installations are "islands" of automation in which, typically one robot tends from one to five machines. However, the trend is to link several such work cells to produce an integrated, flexible manufacturing system, the processes within which have been rationalized for optimum equipment utilization and efficiency.

In the case of automated "islands", justification is usually based upon the cost of displaced labor without regard for a multitude of other real cost benefits. Hence, economic screens of 35 percent plus ROI or less than a 2 year payback limit robot usage to 2 shift operations (less than 15 percent of all manufacturing) or 2 plus workers displaced by each robot. This, in spite of the fact that a typical robot cost less than $6 per hour to operate (installation, depreciation, power and maintenance included) as opposed to typical labor rates, with fringes, of $15 to $25 per hour.

Integrated systems of robot work cells are usually more cost effective because of a number of attendant economic benefits not always present in "islands". Some of these factors are: reduced in-process inventory; less factory floor material handling; less scrap/rework; improved product quality; better factory management and information feedback; predictable throughput; improved high cost capital equipment utilization.

But even with "islands" of automation, the real improvement in productivity and other important cost factors is proven time and time again for those who are willing to invest in and take the risks of innovation.

It has been emphatically stated many times and in many places that one of the major deterrents to advancement in manufacturing methods is management attitudes; not blue collar but white-collar blockades.

Another quotation speaks to the point:

"Executives too often forced to act by short-term pressures or lured by the siren song of the quick payback are steering a course hostile to productivity's growth. Restoring that growth will require many changes—and true leadership."—SOURCE UNKNOWN

The required leadership comes not only from the board room—for long range planning—but from government—to encourage investment in new equipment and new methodologies and to provide incentives for bold (risky) actions. It comes also from an enlightened labor force, ready and eager to be trained for and take on new jobs created by technical innovation.

There is fear that robots will take jobs away from people. To an inconsequential degree, they will, but they will also perform tasks which humans will no longer accept. More importantly, robotics and all of the other advancing technologies will create jobs, not only to build the new equipment but to operate and maintain it—while at the same time ever increasing our affluency. The history of the first industrial revolution proves it. Already, blue collar workers have been retrained and upgraded to tend the robots and a variety of new technology machines, with great skill and satisfaction. Even in its current infancy, the robotics industry itself has generated an estimated 10,000 jobs.

One estimate of the robot industry's growth in the next ten years is 35 percent per year or approximately $2.2 billion in 1990. This suggests a robot population of 60–100 thousand in 1990. If our total workforce is then 200 million of which 20 percent is engaged in manufacturing, the percentage of robots in the workforce would be a minuscule 0.25 percent.

It will probably be greater for a number of reasons. But even if it were double, or triple it can be readily seen that robots are not a threat to the worker. In fact, the industry itself, together with the results of increased manufacturing productivity, will undoubtedly generate more (and better) jobs.

The real issue regarding the blue collar workers in a technologically advancing economy is training. This, too has been stated many times. But we would do well not to think only in terms of robotics but in terms of our entire computer driven world and the sophisticated machines it has generated. Skilled technicians, programmers and engineers of all kinds are needed. New programs are required to develop the required curricula, particularly at the vocational school level. And subsidies or tax breaks should be considered for in-plant, on-the-job training as well as company supported outside programs.

We have neglected this urgent need. If we continue to do so it will not be robots that take jobs—it will be our competitors.

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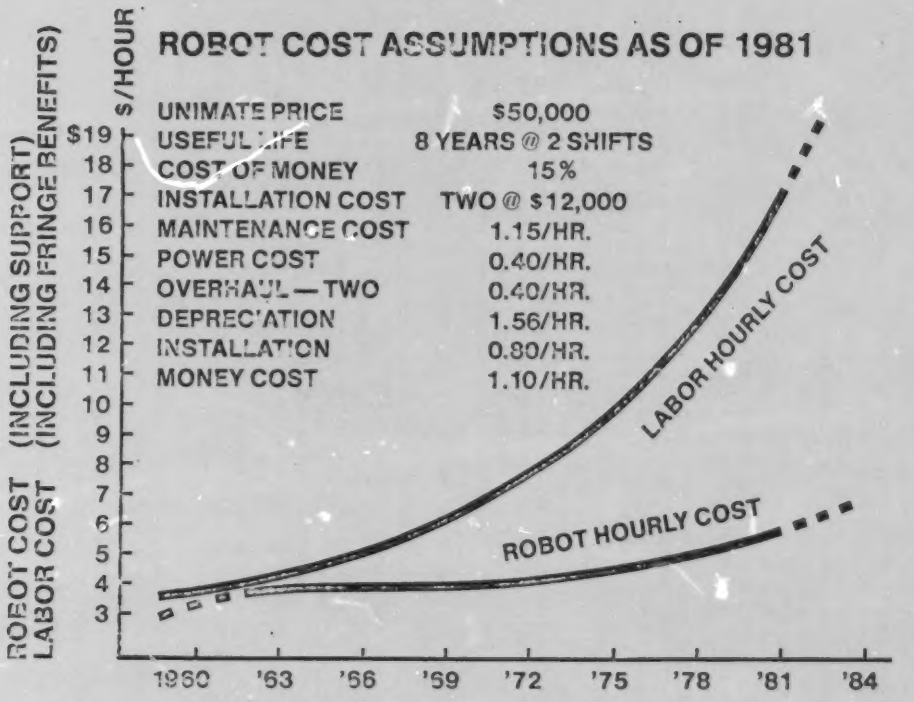


HISTORY OF LABOR COST AND HISTORY OF UNIMATE ROBOT COST IN THE AUTOMOTIVE INDUSTRY

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Mr. MILLER. Mr. Wisnosky?

**STATEMENT OF DENNIS WISNOSKY, VICE PRESIDENT, GCA INDUSTRIAL SYSTEMS GROUP**

Mr. WISNOSKY. I would just start it off by saying good morning. I am going to have to change the first word that I say.

I am going to be reading in my written testimony to you, why I believe we need the factory of the future, when it will come about, how it will be achieved, and then, most importantly, from your context, what it means to the individual worker from my own personal viewpoint.

I think that, first, I would like to state why I think America is suddenly occupied with the factory of the future. I think the answer is quite simple.

Americans need jobs. Today, there are approximately 257,000 American auto workers collecting unemployment benefits. And to those that say that automation is the cause of this unemployment, I would like to point out that there are less than 20,000 robots at work in American factories.

And clearly, their existence is not the cause of our problem. Rather, it can be argued that one reason for high unemployment in this country today is that robots and other automation technology does not exist in greater numbers in America.

One leading industrialist has been quoted as saying that today American industry must automate or emigrate. I would add, or expire, to these choices. Clearly, automation is the one chance we have to compete, let alone survive, in world markets.

There are many reasons for our competitive decline. No one would argue that the decline isn't—hasn't been going on for some time. Some have to do with our own inability to accept the nature of international competitiveness.

And others have to do with the fact that other countries are simply better organized, and to an extent, are better equipped emotionally and educationally to deal with the very, very complex problems of industrial productivity.

We compete in the world market with countries which have had what we are only beginning to talk about here today, such as national productivity programs, and we have none. They have exported their unemployment to us, and artificially supported their basic industries, and we have not.

They have adopted automation technology to save and create jobs; we have been exporting jobs to nations that have so-called cheap labor. We have been mediating over the possible negative effects of automation, and they have been automating.

In my opinion, the consequences of waiting for perfect solutions is simply no longer acceptable. I believe that American industry finally understands the problems of productivity and is positioning itself to do something about them.

We are betting on automation technology, robots, computers, information management systems, CAD/CAM systems, factory control systems and smart processes, and I think that we are finally understanding that manufacturing is truly based upon technology.

American industry is today beginning to demand solutions no less exotic than those that built our chemical and computer industries, which are still preeminent in the world, not to mention an agri-business that can literally feed the world.

How far can these technologies take us?

I don't believe that the day is soon at hand when a single button can be pushed at one end of a factory and the car of your choice will appear at the other end. However, examples do exist that are not far from this ideal, primarily they are in Japan, West Germany, and in Scandinavian countries.

The celebrated Nisson plant assembles 1,300 cars in an 8-hour shift with 67 workers. Fujitsu Fanuc, the No. 1 robot company in the world in the eyes of many, is geared to produce 100 robots a month in a plant that is practically unmanned for two shifts a day. Yet it is described as only being 62 percent efficient, or perfect, and they apologize for that.

In West Germany, there is a plant that produces machined parts for fighter aircraft in a totally automated flexible manufacturing system. In these industries, I know of nothing in the United States that even comes close.

The goal of the Japanese program, called MUMS, which is a national program, methodology of unmanned manufacturing system, is to reduce by two orders of magnitude the manpower required to produce certain classes of machined parts. And they are succeeding.

The West Germans have combined with Sweden, Norway, and Denmark in an international automation project targeted at outdoing the Japanese.

So, while we are talking about getting our act together internally, there are some countries that are beginning to actually work together internationally.

Look at the so-called flexible manufacturing factory built by Yamazaki Machinery Works. The factory is intended to run in three shifts: Five persons on first shift; five persons on second shift; and the third shift is unmanned.

In a conventional factory, the same capacity would require 210 workers running 3 shifts. The in-process time for that factory is 3 days, otherwise it would take 90 days in a conventional factory.

Most American managers look at these statistics and question them. Soon they will be able to go to a Yamazaki plant in Florence, Ky., to see how it works for themselves.

As American industrial managers, we have to ask ourselves the serious question: If the Japanese have been able to go this far using technology largely made in America, how far will they go now that they have begun to invent for themselves? And they have begun.

Today, they are at work developing manufacturing technology based upon artificial intelligence, lasers, and morphological machines. Those are machines that reconfigure themselves for different purposes.

In my opinion, our answer to this challenge must be based upon still superior technology. Factory of the future technology, however, will not only address productivity based upon output-per-man-hour. I think that that approach is short-sighted. It must also ad-

dress economical production of a variety of products that are produced in small batches—we will then be talking about economy of scope, not economy of scale—acceptable product quality, rapid response to materials and process changes, and full use of assets such as capital equipment, energy and materials.

When will the factory of the future come? This is an often-debated question.

There is no question that it is coming, and I don't believe that anyone will ever be able to say at one point in time that it has indeed arrived. But we have to say instead that it will evolve. It won't come tomorrow. But it probably will take the next decade or two to physically achieve that which we know how to do technologically today.

Primarily, the delay in us getting on with it, in order to meet the competitive challenges that I have outlined, is due to the American insistence on a management strategy of adapting to change, rather than managing change.

I have submitted two papers to add to the official record, one titled, "How Far Can You Go? The Integrated CAD/CAM Factory," and the other called "Management Planning for Introduction of Industrial Robots," which talk about how, and how fast we can indeed achieve the factory of the future.

The next question I would like to address is, what will the factory of the future be like?

I think that there are three words that can describe this factory: It will be efficient, flexible, and effective.

What do we mean by these words? Consider efficiency. American industry has learned how to be efficient in a way unparalleled in the world. Simultaneously, we developed transfer lines, mass marketing and mass distribution.

During that process, we became known as both the producers and the consumers of the world. Efficiency, as we described it then, was easy as long as people were content to limit their options.

But today, the world is different. Henry Ford said of the old world, that his customers could have any color that they wanted as long as it was black. From a technological point of view, the fact was that black was the only color that dried fast enough to not slow down the assembly line.

In today's world, manufacturing efficiency by itself is not sufficient to maintain competitiveness. By its nature, it limits the ability necessary to direct and respond to constantly changing world markets.

Consider flexibility, the second characteristic of the factory of the future. Flexibility keeps production equipment economical in the face of change. Rather than concentrating only on units per hour, which is the goal of efficient transfer line technology, and that kind of technology doesn't worry about whether those units have a final market, the goal—of flexible automation is, by definition, reprogramable to do a variety of operations with the same production equipment.

Humans are, of course, the most flexible workers on the factory floor, but today, robots are the most flexible, economical factory workers. More importantly than that, however, robots improve our

capital utilization. As production needs change, the robot can be reprogramed and need not be scrapped and new tooling bought.

That is why I think it is important in all of these discussions about robots, to compare them not to people, but to reduction in the utilization of capital, capital that is thrown away with scrap, for example, and with energy that is consumed, and need not be consumed, and with tooling that has to be thrown away when we have the need to change product.

The third characteristic of the factory of the future—and I think that this is the most important one—is effectiveness.

Certainly the most important characteristic from the workers' standpoint. Tomorrow's factories must be effectively organized to do the right thing with productive and happy people.

In earlier testimony, you heard about the successful office of the future. The concept of effectiveness is more or less the same. In introducing technology, organizations must change. Effectiveness is doing the right thing as opposed the traditional American single-mindedness of doing the thing right.

Effectiveness in the factory of the future is achieved by applying the principles of computer integrated manufacturing, or CIM. In CIM, all functions of manufacturing are organized and controlled by an integrated data base.

This forces traditional organizational barriers to be broken down and leads to real communication between people, communication between design engineers and manufacturing engineers, for example.

The real promise of the factory of the future is to provide the appropriate balance of the efficiency of traditional large-scale operations, the flexibility of today's robots on the shop floor, and the effectiveness of tomorrow's computer integrated manufacturing systems.

How will the factory of the future affect the worker? In all honesty, I think that if we go about this right, I can only see benefits for all of us. And the consequences of not proceeding, as the previous speakers began to allude to, are certainly negative. And that is without the technology, we simply will not be able to compete.

I can only see benefits, as I said, for all of us. And this is the opinion being put forth by most of our industrial leaders, and I think that it is time that we all start thinking this way.

We should be already past the panic stage. In England, where the reaper was first demonstrated for grain harvesting, its inventors were stoned by people who felt that their jobs were threatened.

Back in the 1950's, we were warned that computers would cause mass unemployment. Exactly the opposite has occurred. In 1955, there was a Congressional Subcommittee on Automation that received numerous testimonies that intolerable unemployment would result due to data processing automation.

Since that time, the number of persons with jobs in the United States has risen from 63 million to 109 million, certainly not the "doom and gloom" predicted. Data processing automation did cause job displacement, not unemployment. I think the same will be true with the coming of the factory of the future.

Congressional staff economist Richard K. Vedder supports this view in a new report from the United States Congressional Joint Economic Committee. He said, "History shows that labor-saving technologies have led to improved living standards, higher real wages and employment growth. Robotics will raise productivity and with that, the material rewards to employers and employees alike."

How will the worker feel? In my travels while manager of the Air Force Integrated Computer-Aided Manufacturing Program, which included factories not only in the United States, but all over the world, I went through many unionized plants, and of course, many that weren't unionized.

Then, as now, as an automation technology supplier, I have never been confronted by a hostile work force, or even a hostile worker, I might add. Who among us wants to do some of the jobs that were shown on the previous film, such as to spend 8 hours hoisting an 80-pound, white hot forging; or hefting a 60-pound grinder while wearing a respirator and ear plugs and standing in a sand pit; or putting the same light bulb into the same socket over and over again.

These are the realities of the shop floor. In my opinion, automation technology should be used to provide a better life for our workers, even if our competitors do not force us to automate.

In June 30, 1980, issue of Newsweek, there was an article by an auto worker named John Hilton. He said, and I quote, "I'd rather be replaced by a machine than compete with one, especially if that machine is being run by a foreign worker, producing goods for the United States."

Our workers, in my opinion, realize the state of our productivity, and our international competitiveness, but they need help, and so do all of our industrial leaders.

What should be done? I have outlined four things that I think we should begin to think about, and this committee should work on as well.

First, let me say that my recommendations are based upon the psychological axiom that "behavior changes before attitude." In other words, I am saying that I think it is time to pick some targets and get on with it, rather than continuing to look for better data to help us understand the problem.

In other words, as a nation, we should embark upon a course of behavior that simultaneously solves our productivity problem, takes care of our people, and leaves us with a positive attitude to help prevent the problems we are facing now from reoccurring.

What are some of the things I think we should do?

First, I recommend that we combine the best of academia, government and industry—and I should add here that when I say industry, from my point of view, I don't mean that I am talking about the industrial leaders that own the factories, or manage the factories, I mean management with labor. In my vocabulary opinion, the word industry describes people that work in the factories, and people that own and manage them.

So we should combine the best of academia, government and industry, to sponsor joint productivity improvement programs. These programs would try out factory automation ideas in very, very big

ways, in ways that should approach the magnitude of the space program of the 1960's.

The space program created spin-off technologies, products and even whole industries, and I think we are still benefiting from it today. During that program, we literally forced universities to train people to become experts in computer programing and integrated circuits. In fact, they were created during that timeframe.

In that process, we were left with a whole new generation of technologists. Companies, at the same time, took that technology and turned it into new products; new products that people wanted and new products that served their intended purpose of furthering the space effort. There was a healthy synergism there. Government provided seed money and leadership to create a climate where growth could occur. It ended up being economic growth and growth during that period in the number of jobs.

Twice during the past 10 years, we had programs which, I think, might have gone a long way in that direction. One, set up a thing called the National Center on Productivity and Quality of Working Life.

And the second was called Cooperative Generic Technology. Both times, once under a Democratic administration and once under a Republican administration, we lost our resolve before much good was done. Both programs were canceled before they even got off the ground.

The second recommendation, I would recommend tax incentives which would reward our basic industries for investment in manufacturing technology. These tax incentives or credits should go beyond accelerated depreciation of capital investment, which is what we have now. I think that is good. We really need to go one step further.

The approach of accelerated depreciation, in my opinion, is typical of the "new coat of paint" or "more of the same" syndrome. It doesn't say that this technology or that this investment has to do something better. It may well be a 1940 machine tool design that is made in 1982.

Now that American industry is facing the fact that existing tooling simply cannot compete, it must have financial help to get on with the job at hand. Further, I believe we should even consider protection or direct subsidies for those industries experiencing foreign competition that could be called unfair.

Third, trade union involvement. The unions, of course, represent the workers. They have to jump on the bandwagon, and I think they are. Rather than fight automation, they must stand up for their rights while automation is being implemented.

The workplace is going to change, and our unions should be demanding that a certain portion of the workers' time be dedicated to reeducation and training the workers for the new workplace.

In Japan, in most cases, about 25 percent of a worker's time is allocated for education. That is also one way that they get lifetime employment; part of that time is spent training for the next job.

In my opinion, retraining rights should be built into the wage structure, the same as vacations and other fringe benefits.

Fourth, I would recommend the Government encourage technology transfer as demonstrated in the Stevenson-Wydler Technology

Innovation Act of 1980. If that program were funded, application offices would be set up to introduce and integrate new technologies into the private sector.

Tax dollars are pumped into Federal laboratories while little is done to commercialize the products and processes developed in them.

In conclusion, let me say that as a Nation, our real need is to learn to work together for the common good. As I said before, we need to begin to change our attitudes about ourselves. The best way to do this is to practice working together; government, industry and academia. The Government must provide the leadership model and a consistent, positive climate for this to occur. Otherwise, it certainly will not.

When talking about automation and technology, we should remember that a rising tide lifts all boats. Now is the time for our national leaders to understand industry's needs, and to take positive action to bring about the factory of the future to the benefit of all American workers.

[Material submitted by Dennis Wisnosky follows:]

**PREPARED STATEMENT OF DENNIS E. WISNOSKY, GROUP VICE PRESIDENT, GCA CORP.**

Good Morning Ladies and Gentlemen.

It gives me great pleasure to address this important committee, and to share with you some of my personal ideas on the Factory of the Future. I base these ideas on my 15 years of experience in high technology and factory automation, in government, academia and in private industry. Today, I will address why we need the Factory of the Future, when it will come about, how it will be achieved, and, what it means to the individual worker.

First, why does America suddenly seem to be preoccupied with the Factory of the Future? I think the answer is quite simple. Americans need jobs. Today, there are approximately 257,000 American auto workers collecting unemployment benefits. To those who say that automation is the cause of this unemployment, let me point out that there are less than 20,000 robots at work in American factories today. Clearly their existence is not the cause of our problem. Rather, it can be argued, that one reason for high unemployment is that robots don't exist in greater numbers.

One leading industrialist has been quoted as saying that today American industry must "automate or emigrate." I would add "or expire" to these choices. Clearly, automation is the one chance we have to compete - let alone survive - in the world market.

There are many reasons for our competitive decline. Some have to do with our own inability to understand the nature of international competitiveness. Other reasons have to do with the fact that other countries are simply better organized, and to a certain extent, are better equipped emotionally and educationally to deal with the very, very complex problems of industrial productivity.

We compete in the world market with countries which have had national productivity programs - we have not. They have exported their unemployment to us and artifically supported their basic industries - we have not. They have adopted automation technology to save and create jobs - we have been exporting jobs to nations that have "cheap" labor. Rather than meditating over the possible negative effects of automation, they have been automating.

In my opinion, the consequence of waiting for perfect solutions is simply no longer acceptable. I believe that American industry finally understands the problems of productivity and is positioning itself to do something about them. We are betting on automation technology, including robotics, computers, information management systems, CAD/CAM systems, factory control systems and smart processes, to begin to solve some of our basic productivity needs. We finally understand that manufacturing is truly based upon technology. American industry is demanding solutions no less exotic than those that built our chemical and computer industries, not to mention an agri-business which can literally feed the world.

How far will these technologies take us?

I do not believe that the day is soon at hand when a single button will be pushed at one end of a factory and the car of your choice will appear at the other end. Examples do exist, however, that are not far from this ideal - primarily Japanese, West German, and Swedish examples. A Nisson plant assembles 1300 cars in an eight-hour shift with 67 workers. Fujitsu Fanuc is geared to produce 100 robots a month in a plant that is practically unmanned for two shifts a day. Yet it is described as being only 62% perfect. A West German aircraft plant produces machined parts for fighter aircraft in a totally automated flexible manufacturing system. In these industries, I know of nothing in the United States which comes close. The goal of the Japanese national program called MUMS (Methodology of Unmanned Manufacturing System) is to reduce by two orders of magnitude the manpower required to produce certain classes of machined parts. They are succeeding. The West Germans have combined with Sweden, Norway and Denmark in an international automation project targeted at outdoing the Japanese.

Look at the so-called Flexible Manufacturing Factory built by Yamazaki Machinery Works outside of Nagoya, Japan. The factory is intended to run in three shifts: five persons on first shift; five persons on second shift; and the third shift (midnight to 8:00 a.m.) is unmanned. Compare this to conventional machine tool methods. The same production capacity would require a total of 210 workers running three shifts. The in-process time for this factory is three days. It would take 90 days in a conventional factory. Most American managers I know look at these statistics and question them. Soon they will be able to go to a Yamazaki plant in Florence, Kentucky to see for themselves.

As American industrial managers, we have to ask ourselves the serious question: If the Japanese have been able to go this far using technology largely made in America, how far will they go now that they have begun to invent for themselves? And they have begun. In fact, they began about 10 years ago. Today they are hard at work developing manufacturing technology based upon artifical intelligence, lasers, and morphological machines. (Morphological machines reconfigure themselves for different purposes.)

Our answer to this challenge must be based upon still superior technology. Factory of the Future technology will not only address productivity based upon output-per-manhour. It will also address economical production of a variety of products in small batches, acceptable product quality, rapid response to materials and processes changes, and full use of assets such as capital equipment, energy and materials.

When will the Factory of the Future come?

The Factory of the Future is coming, and rather than try to answer the question of how fast, let me say instead that it will evolve. It will not come tomorrow. It will take the next decade or two to physically achieve the Factory of the Future which is technologically possible today. Primarily the delay is due to American insistence on a management strategy of adapting to change, rather than managing change. I refer you to two of my own papers which I have passed on to the subcommittee: one entitled "How Far Can You Go? The Integrated CAD/CAM Manufacturing" and the other "Management Planning for Introduction of Industrial Robots." These provide some definitive examples of how and how fast we will achieve the Factory of the Future.

What will the Factory of the Future be like?

I can answer this in three words:

Efficient
Flexible
Effective

Consider efficiency. Since the Industrial Revolution, American industry has learned how to be efficient in a way unparalleled in the world. Simultaneously we developed transfer lines, mass marketing and mass distribution. We became known as both the producers and consumers of the world. Efficiency was easy as long as people were content to limit their options. Henry Ford said that his customers could have "any color that they wanted as long as it was black". In today's world, manufacturing efficiency by itself is not sufficient to maintain competitiveness. By its nature, it limits the ability necessary to direct and respond to constantly changing world markets.

Consider flexibility. Flexibility keeps production equipment economical in the face of change. Rather than concentrating only on units per hour, (the goal of efficient transfer line technology), flexible automation is, by definition, reprogrammable to do a variety of operations with the same production equipment. Humans are, of course, the most flexible workers on the factory floor. But robots are now taking their place as the most economical flexible factory workers. Most importantly, though, robotics improve our capital utilization. As production needs change, a robot can be reprogrammed. It need not be scrapped and new tooling bought.

Consider effectiveness. Effectiveness, is perhaps the most important characteristic of the Factory of the Future from the workers' standpoint. Tomorrow's factories must be effectively organized to do the right thing with productive and happy people. However, effective organization goes much deeper than worker acceptance of new technology. It is doing the right thing as opposed to the traditional American single-mindedness of doing the thing right. Effectiveness in the Factory of the Future is achieved by applying the principles of Computer Integrated Manufacturing, or CIM. In CIM, all functions of manufacturing are organized and controlled by an integrated computer database. This forces traditional organizational barriers to be broken down and leads to real communication. For example, lack of communications between design engineers and manufacturing engineers often causes expensive mistakes to be made.

The real promise of the Factory of the Future is to provide the appropriate balance of the efficiency of traditional large-scale operations, the flexibility of today's robots on the shop floor, and the effectiveness of tomorrow's computer integrated manufacturing systems.

How will the Factory Of The Future affect the worker?

I can see only benefits for all of us. This is the opinion being put forth by most of our industrial leaders and it is time that we start thinking this way. We are already past the panic stage. In England, where the reaper was first demonstrated for grain harvesting, its inventors were stoned by people who felt that their jobs were threatened. Back in the 1950s, we were warned that computers would cause mass unemployment. Exactly the opposite occurred. In 1955, the U.S. Congressional Subcommittee on Automation received numerous testimonies that intolerable unemployment would result due to data processing automation. Since 1955 the number of persons with jobs in the U.S. has risen from 63 million to 109 million - hardly the "doom and gloom" prediction we heard in 1955. Automation causes job displacement, not unemployment. We expect the same will be true with the coming of the Factory of the Future.

Congressional Staff economist Richard K. Vedder supports this view in a new report from the United States Congressional Joint Economic Committee:

> "History shows that labor-saving techniques have led to improved living standards, higher real wages and employment growth...Robotics will raise productivity and with that, the material rewards to employers and employees alike."

How will the worker feel?

In my many travels while manager of the Air Force Integrated Computer-Aided Manufacturing program, I went through many unionized plants. Then, and now, as an automation technology supplier, I have never been confronted by a hostile work force. Who among us wants to spend eight hours a day hoisting eighty-pound, white hot forgings; or, hefting a sixty-pound grinder while wearing a respirator and ear plugs and standing in a sand pit; or, putting the same light bulb into the same socket over and over again. These are the realities of the shop floor. Automation technology should be used to provide a better life for our workers, even if our competitors do not force us to automate. On June 30, 1980, Newsweek carried an article by John Hilton, an auto worker. He said, "I'd rather be replaced by a machine than compete with one ... especially if that machine is being run by a foreign worker, producing goods for the U.S." Our workers realize the state of our productivity, but our workers will need help and so will our industrial leaders.

What Should Be Done?

First let me say that my recommendations are based upon the psychological axiom that "behavior changes before attitude." In other words, as a nation, we should embark upon a course of behavior that simultaneously solves our productivity problem, takes care of our people, and leaves us with a positive attitude to help prevent our problems from reoccurring.

ONE - JOINT PRODUCTIVITY PROGRAMS

First, I recommend that we combine the best of academia, government, and industry to sponsor joint productivity improvement programs. These programs would try out factory automation ideas in very, very big ways - in ways that should approach the magnitude of the space program of the 1960s.

Our space program, for example, created spin-off technologies, products and even whole industries. We are still benefitting from it today. During that program we literally forced universities to train people to become experts in computer programming and microprocessors. This created a whole new generation of technologists. Companies, at the same time, took that technology and turned it into new products: new products that people want to use and new products that furthered the space effort. The government provided seed money and leadership to create a climate where growth could occur - economic growth and growth in the number of jobs.

Twice during the past ten years, we had programs which might have gone a long way in this direction: first, the National Center on Productivity and second, Cooperative Generic Technology. Both times, once under a Democratic administration and once under a Republican administration, we lost our resolve before much good was done.

TWO - TAX INCENTIVES

I would also recommend tax incentives which would reward our basic industries for investment in manufacturing technology. These tax incentives or credits should go beyond accelerated depreciation of capital equipment. This approach is typical of the "new coat of paint" or "more of the same" syndrome. Now that American industry is facing the fact that existing tooling simply cannot compete, it must have financial help to get on with the job at hand. Futher, I believe we should even consider protection or direct subsidies for those industries experiencing unfair foreign competition.



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THREE - UNION INVOLVEMENT

The unions, of course, represent the workers. They have to jump on the bandwagon as well. Rather than fight automation, they must stand up for their rights while automation is being implemented. The workplace is going to change, and our unions should be demanding that a certain portion of the workers' time be dedicated to re-education and training. (In Japan, 25% of a worker's time is allotted for education.) Re-training rights should be built into the wage structure, the same as vacations and other fringe benefits.

FOUR - TECHNOLOGY TRANSFER

Finally, I recommend the government encourage technology transfer as demonstrated in the Stevenson-Wydler Technology Innovation Act of 1980. If this program were funded, application offices would be setup to introduce and integrate new technologies into the private sector. Tax dollars are pumped into our federal laboratories and comparatively little is done to commercialize the products and processes developed in them.

In conclusion, let me say that as a nation, our real need is to learn to work together for the common good. As I said before, we need to begin to change our attitude about ourselves. The best way to do this is to practice working together: government, industry and academia. The government must provide the leadership model and a consistant, positive climate for this to occur.

When talking about automation and technology, let's remember that a rising tide lifts all boats. Now is the time for our national leaders to understand industry's needs - to take positive action to bring about the Factory of the Future for the benefit of all American workers.

# How Far Can You Go?—The Integrated Cad Cam Factory

(Presented to the Financial Post Conference, Ottawa, Canada, Wednesday, February 17, 1982, by Dennis E. Wisnosky, GCA Corp., Group Vice President, Industrial Systems Group)

Good afternoon Ladies and Gentlemen. It gives me great pleasure to address you in discussing "How Far Can You Go - - The Integrated Cad Cam Factory". In order to specifically address this question as billed, I will give you ten direct predictions of what should be possible within ten years in the ten most significant technological areas of the "factory of the future." I am going to answer the question "How far can you go?" in a very rote way. The more important question is, of course, how can this be achieved. I will provide you with a rather cook book approach of how to convert from the technology base to this elusive "factory of the future (FOF)." Finally, let me - up front - give you my conclusion - - the technology is really not the problem at all in reaching the FOF. It is the attitude of its practitioners in dealing with people and organizations.

I'm really the bridge speaker in this program, as I've discovered today, because this morning we have heard a number of very eloquent talks on organization at even the International level and in the next day and a half, you will be hearing about specific technology successes that others have had. For my part, I will leave you with the understanding that it is (1) linkages between technologies, (2) functions that people are asked to perform, and (3) how organizations are structured to integrate people, technology and functions that is most important to transitioning between today and the FOF.

Now for the predictions:

(1) It will be possible to fully describe the functions of manufacturing, its information content and the dynamic interaction of all subsystems. A software architecture will take the place of pilot plants and prototypes for system development.

In this statement we are talking about the need for building a road map for the POF. I believe that the need for and complexity of this roadmap will be equivilant to the roadmap that the United States used to get man on the moon. The need for this roadmap is really the same as that of a contractors blueprint to build a building or an engineers schematic to build a computer. We never question these needs, yet a road map which plans most companies' future manufacturing capability almost never exists.

(2) Flexible and automated fabrication stations, cells and centers will be implemented in the areas of sheet metal, machined parts and composites. The Computer Integrated Factory will be on the horizon.

Those are probably the three target based process technologies of the POF about which we should be concerned. This is true simply because they represent the greatest magnitude of both present and future shop floor opportunity.

(3) Computer power equivalent to today's large manufacturer will be available on the shop floor. All manufacturing functions will be integrated through a common data base structure including planning control and decision making.

This is a very safe prediction, because at least three such hardware products will be introduced this year. Software will take more time of course, but the architecture will show how to put it together.

(4) CadCam systems, and I always describe Cad and Cam as a single word, will give way to Computer Integrated Manufacturing systems from which users at all levels will access the design-manufacturing support capability required.

In this thought we are talking about the linkage problem being solved not by interface between Cad and Cam but by data base interaction between design and manufacturing.

(5) There will be a single integrated capability for manufacturing planning, making and administering schedules, planning production, and providing production resources. Capacity and facility planning will be algorithmically based. Group Technology (GT) will support decision making far broader than cell utilization on the shop floor.

(6) Manufacturing control will be handed off from planning and will include materials management. The loop will be closed through data input of planning algorithms.

(7) Flexible centers for sheet metal subassembly and hybrid subassembly will be operational. Integrated fabrication and assembly will be on the horizon.

(8) Integrated decision support systems will be available for most manufacturing functions. Use of simulation for planning and decision making will be extended to factory control.

The idea is that prior to building an automatic factory we can simulate entirely how it's going to work. One of the thoughts that continues to amaze me is that we never question the fact that we can take a complex system such as a 747 aircraft, worth about $50 million, put it into a computer algorithmically, and have a pilot in training operate that 747 through every single flight profile possible and, hopefully, make all of his crashes in the computer. Yet we'll build a factory and invest a billion dollars in it and have no more than one seat-of-the-pants idea of what's really going to happen when that factory goes into operation.

(9) **Robotics will be the physical integration mechanism of the factory.**

As I will show you later, robotics is a major part of the GCA Corporate strategy. But I tend to think of robotics simply as being the "sizzle on the steak," not the steak itself. It is equivilent to the wafting smell of bacon and eggs that came from Mama's kitchen and made you want to get up on a school day, but it really did not provide sustenance itself. We realize that robots are sexy right now and that is how it should be, but integration of information provides more factory productivity improvement opportunity than labor replacement.

(10) **"Smart" fabrication and assembly cells will perform "in situ" inspection. Good product will, by definition, be the only product.**

Having answered the question how far can you go, next we are going to talk about the reason for wanting to make the massive investments to get there.

We are talking about productivity, of course. Lack of increasing productivity, to every worker, is really simply seen as a lessening of the amount of dollars that one has to show for the work that one is doing.

Technology, capitol, and people are the three most important parts of the productivity equation. Technology is number one. It accounts for well over half of the productivity equation. The objective, of course, is to invest capitol in technology that people need to perform productively.

The technology base for the factory of the future, is (1) processes - including machining, forming, casting, forging, drilling, inspecting, coating, moving, positioning, and assembling - and (2) systems - including designing, controlling, inventorying, grouping, monitoring, releasing, planning, scheduling, ordering, changing, communicating, forecasting, predicting, and analyzing. What we've found through the years is that we have tended to invest more and more resources in process technology, until we have the cost component of process technology so small that it is almost impossible, except by making exotic changes in materials, to continue to make major productivity improvements in that area. Instead what has happened is that systems have taken over as accounting for nearly 70% of manufacturing costs.

Factories of the future will be built by turning components of the technology base into products including: CADCAM Systems, Robots, Controls, Computers, Information, and Smart Processes. These products are themselves accounting for a major new growth industry expected to reach $25 billion in the U.S. by 1990. It is next important to know where to apply these products in solving manufacturing problems. That is, what are the cost components of manufacturing. In general, they are: finance - 10%, engineering - 5%, managerial - 10%, indirect labor - 15%, direct labor - 10%, and materials -

50%. It surprises many people to see that materials by far count for most of the costs of finished products. Direct labor, which is where making improvements in unit processes appears, accounts for the smallest cost component. From this knowledge, we see that we have to address the POF from many points of view. In my opinion, the Japanese use the three most important points of view:

(1) Robots - to reduce labor costs

(2) "Kan ban" or "Just in Time" materials flow - to reduce materials costs.

(3) Quality committment beginning with people.

Recognition of multiple viewpoints causes us to extend the definition of manufacturing far above the shop floor. It should now be:

> **A series of interrelated activities and operations involving the design, materials selection, planning, production, quality assurance, management, marketing and delivery of discrete consumer and durable goods.**

But if the key to the POF is integration of technology, then we must even further expand the definition of manufacturing to be Computer Integrated Manufacturing:

> **The logical organization of individual engineering, production, and marketing/support functions into a computer integrated system. Functional areas such as design, inventory control, physical distribution, cost accounting, planning, purchasing, etc., are integrated with direct materials management and shop floor data acquisition and control.**

This is the definition that is accepted in the U. S. right now. It was published in American Machinist last September and, since it is mine, I have a little pride about that fact.

From the business point of view, the thing that is important about this definition is its conclusion, that is: that integration can be done in a such a way that strategic plans give way to tactical operations at known costs.

What will be gained by true CIM - the goal is to move from the factory world of today with its:

- High cost labor intensive loosely coupled operations
- Unstable use of materials and constantly changing requirements
- Discontinuous functions whose productivity and return are all but impossible to measure.

...To Tomorrow's world, where factories are:

- Efficiently integrated and continuous
- Flexible and economical in the face of change
- Effectively organized to do the right thing with maximum productivity and happy people.

There are three words here that are crucial. Efficient, flexible, and effective. Any one of those words taken by itself can be properly viewed as being somewhat motherhood. After all, transfer lines are the most efficient, manual labor is the most flexible and, whatever works is in the afterthought, the most effective.

The assertion of the FOF is that we can integrate efficiency with flexibility and with effectiveness. An example of how is seen in combining Group Technology (GT), which gets us very efficient manufacturing cells, with the effectiveness of manufacturing resource planning (MRP), which has that cell doing the right thing at the right time. That is, it is effective.

When will the factory of the future be here? That depends on you. The final answer is not technology at all. We will start here to give you a more or less cookbook approach of how to apply the technology, if that is your interest.

First, accept that the FOF must evolve. It's not going to happen tommorow. It's going to have to happen in an evolutionary fashion by planning long range and top down, and by implementing short term and bottom up. I think that the best way to do this is to divide the problem up into small pieces. And I'll make the analogy here again with the space program. The first thing that the U.S. did was to shoot a rocket into the atmosphere. When it came back down it taught us at least what the atmosphere was like. The next advance was to circle the earth, then the moon, and then to the moon and back with no people and then to the moon and back with people.

I would like to think of the factory in similar terms. If we look at factories top down in terms of being composed of centers, cells, stations, and processes, each at a lower level of complexity, then we can implement in the reverse order. In other words, take the problem wherever it is found and address integration in a piece meal fashion over a long period of time but with the linkages known in advance.

What happens at each one of those levels in the hiearchy? At the process level we "make," at the station we "move," at the cell we "monitor and control," at the center we "manage," and at the factory we "direct." Next, we must look at the component parts from the technology point of view at each of the levels.

Unit processes do the traditional work; they also account for only 20-30 percent of the product cost. Systems are the life blood of the organization; they manage the flow of information and control the flow of materials and the scheduling of people and machines. They also account for 70-80 percent of non material product cost. Therefore, the majority of our attention should properly be in this area, but it is the most difficult area with which to deal. Developing integrated systems demands total commitment for the long term. Significant investment is required, and if the system is to truly work in an integrated way, it must be designed top down before the first subsystem

is built. At the same time, keeping in mind the real pressures and needs to pay as you go, there must also be short-term payoff. Therefore, the systems must be built bottom-up.

The top-down plan—bottom-up build idea is well accepted and easy to understand. The problem becomes how to translate this concept into an action plan. This problem becomes largely one of syntax and semantics, that is — meaning and form. The objective is to build the factory, but we must start with the basic process. Therefore we should follow a strategy of:

PLAN LONG RANGE
AND
TOP DOWN

FACTORY
CENTERS
CELLS
STATIONS
PROCESSES

BUILD SHORT TERM
AND
BOTTOM UP

Planning: The idea is to plan top down from the viewpoint of an integrated factory. The sequence of centers, cells, stations, and processess reduces the problem into successively smaller entities which can be readily understood and dealt with. Building: This is a bottom-up affair, which is the reverse of planning -- it moves from processes to stations to cells to centers, concluding with an integrated factory. Processes are totally hard technology and easy to understand. As the sequence is moved up, processes are integrated by soft technology into stations, stations into cells, cells into centers, and centers into a factory. Specific examples will follow of how this can work.

First, how do we plan top-down? We start off with the idea of an architecture, a blueprint, a roadmap....a roadmap that is very detailed.

Its purpose is to:

FULLY DESCRIBE THE FUNCTIONS OF MANUFACTURING, ITS INFORMATION CONTENT AND THE DYNAMIC INTERACTION OF ALL SUBSYSTEMS

With this architecture we can model and test planned improvements in our factories prior to going to iron, that is, before making a major investment in facilities or computer software. Exercise of the architecture will thus eliminate the surprises which today occur in systems inplementation, surprises which result in missed schedules and increased cost.

The best way to explain the sequence of bottom up build is by example. Each of the steps in the sequence "process - station - cell - center - factory" has both a hard technology and soft technology viewpoint. The practical approach to the FOF is from the process so we will start there.

From the hard technology viewpoint, we have a choice of how to make a particular part, for example (1) by bulk deformation by extrusion, (2) sheet forming by deep drawing, (3) machining by shaping. Economics should cause us to decide which one of these basic processes to use. The soft technology viewpoint of process allows us to examine materials, tooling effects, equipment characteristics, and, of course, part geometry with respect to one another for each process choice. We consider the most economical way to put these parameters together. Our objective is to match the "best" process with the "best" material at the "best" time, given part geometry. Best is a relative term. When looking at tooling effects or equipment characteristics, for example, in one plant "best" may be different than in another plant for the same part. We must decide what is "best" by using information within the computer, which is presumed to "know" the situation within each plant.

Stations are integration of processes. The hard technology viewpoint of the station, for example might show robots doing grinding, deburring and loading-unloading processes. It is clear that the process together with the robot changes the process to a station. The station from the soft technology viewpoint has to do with how we control the station. The part program comes

from the computer, so that it is not possible to perform this process within this station without a part program. In other words, it cannot be done manually. Adaptive control is also an assumed input. Output for the station is nothing more than a completion signal, everything is o.k., or is not o.k. Adaptive control provides the opportunity to keep things within certain limits.

Cells are the integration of stations. From the hard technology viewpoint of a cell, we might have a punch press, a conveyor, and a robot. We saw, in the definition of a station, that when a robot is integrated with a basic process, a station is created. A cell, in general, is the station integrated with some material management device. In this case, it is a conveyor and a vision system. Here the benefit of the soft technology viewpoint begins to become clear. For example, with the fabrication data created within the design function, the inspect part information is added during design, not as an afterthought. We have gone, then, beyond today's approach of showing the camera a part and then telling the computer, "if you see this part again, identify it." At part creation, the information is put into the same data base that is used at the cell on the shop floor. The only signal from the cell is that it is either done, or that it is not able to complete its assignment.

The integration of at least two cells is a center. From a hard technology viewpoint centers have been described many times, for example, robot welders along a car body assembly line. It is again, however, the soft technology

viewpoint that is most critical. This is because here is where shop floor decision making occurs, for example: materials requirements planning, capacity planning, machine assignment, WIP minimization, and cell definition based upon Group Technology. These manufacturing centers are what people commonly speak of today as an FMS, although the term should be expanded to be any type of flexible fabrication or assembly. The center soft technology viewpoint of the most complex center which is operating in the world today is at MBB in Augsburg, West Germany.

The MBB setup has 24 machine tools, most of which are four or five axis head changing machines. In this system tools are transferred from the tool crib area automatically in overhead pallets. Raw material reaches the machine tools automatically and finished parts are taken away from them automatically. There are stacker cranes for tools, raw materials and finished parts. This system literally runs by itself through a control center that looks much like an airport control tower. People do the watching. Machines do the working. This system gives all of us some targets to shoot for.

Machine utilization in MBB form stand alone machines went up 44%--that is, fixed assets are being used much better. Correspondingly, the number of machine tools could be decreased by 44%. This decreased floor space, the number of people decreased about 50%, and thruput increased 25%. Most importantly, the initial cost was actually less, primarily because of the fact that fewer machines had to be bought. This was so much so, that it even

compensated for the systems technology development so the total initial cost was less than it would have been conventionally. The most important number is the bottom line. In this case, a 24% increase in annual return is claimed.

Today there are 70 to 80 Direct Numerical Control systems in Japan. Of that number about 24 are of the MBB type. In Western Europe there are 24. In the United States there are 12. But, most significantly, the number in the U.S. has doubled every two years since 1972 when this technology was introduced here.

The MBB system is the best example of what can be achieved designing in a top-down way and building in bottom-up manner. In more general terms, remembering that the center is an upward integration, the cell-station process scenario contains:

- INDEPENDENT/MULTIPLE WORK CELLS
- FLEXIBLE ROUTING
- AUTOMATED PART HANDLING, TRANSFER, ORGANIZATION AND STORE
- OPERATION FROM FACTORY CONTROL
- A SYSTEM ORGANIZATION TO PERMIT PHASED DEVELOPMENT AND IMPLEMENTATION AND ADDITION OF NEW CELLS-STATIONS-PROCESSES



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. THE ABILITY TO ACCOMMODATE CHANGES IN:

- LOT SIZE
- WORK LOAD
- TECHNOLOGY

What we are talking about now is not adapting to change, but managing change from top to bottom. The objective is to be able to integrate Centers into the computer integrated factory. While we are not talking about tomorrow, the next 10 - 20 years is well within the realm of possibility. To be sure, we must have some technology first that is not yet here, but it is on the horizon!

Now, to prove to you that this approach is much more than theory, let me point out that at least three major companies, including my own, are building a business based on this idea, as are several venture capitalized firms. The sequence that I described was created by the U.S. Air Force during the time when I lead the ICAM program. In fact, the Process, Station, Cell, Center building block scenario describes the four components of my own Industrial Systems Group.

We look at the computer integrated factory then as being the evolution of integrating these processes, stations, cells, and centers, into the FOF. Now that the cookbook approach to the FOF is understood, is it enough? I think not. Really building the FOF will take a major change in the attitudes of most of us. We need to embark upon a course of self brainwashing that causes us to seek excellence, not opportunity. For example, in Japan, Fujitsu Fanuc talks about a factory which they apologize for because, in making its 100 robots a month, it is only 62% perfect. Yamasaki is building a competitive plant to make robots, and they promise that it will be better.

What are we doing? I think that we are trapped by our own attitudinal problems. Let me give you some more American/Japanese examples, since I have spent quite a bit of time there. In almost every Japanese newspaper there are daily articles about robots. Not about problems with them as in our publications, but about how well they work and how much investment is being made and how good that investment is. By contrast is an article which came out in a major U.S. magazine last week which questioned the good sense of major U.S. companies investing in a business market that was only a 150 million dollars in 1981. This is an example of our attitude problem. So what if the robot business will be $2 billion in 1990 and that without it we may as well say goodbye to our other businesses.

Next is our preoccupation with thinking that there is a union problem. I believe that the UAW knows that the 2000 or so robots in the U.S. are not responsible for more than 200,000 UAW members being out of work. I have seen

no evidence that unions are a problem in our lack of automation. I think that the whole thing is a "red herring" disguising managers who are themselves not willing to accept inevitable change. If the union excuse doesn't work, they talk about economic justification. I've never met an industrial engineer who, when given the answer, couldn't tell management how it came about. It is said that Robert Macnamera, back in the early days of the application of operations research in the DoD, had a job to fill for which he had interviewed three industrial engineers. They were all three sitting in the entryway ready to go in for the interview. The first one went in, came back dejected and related what happened. "Well, he asked me how much one and one was and I said two — MacNamara says that's not the right answer, no imagination." The second goes in knowing now what question has been asked and he is waiting for it. He says, "in binary arithmetic it's one - zero, which is the same as two." MacNamara says "smart aleck" and throws him out the door. The third industrial engineer goes in, whereupon MacNamera repeats the question. The third candidate looks at him, smiles and says, "well boss, what do you want it to be." I am certainly not advocating the implications of that approach, I am only saying that we should all be willing to accept the basic uncertainty of our lives and take necessary risks whether they can be precisely calculated or not. I think that the question of How Far You Can Go, has to do with the old pyschological axium of behavior changes before attitude. I'll give you one last example of the effect of attitude. This one, I think, typifies what is probably the correct perception of service in four different countries. It is a personal story and it has nothing to do with factories. Recently, in the Okura Hotel in

Tokyo, I lost my luggage key, Samsonite luggage, Samsonite American luggage. Samsonite American is different from Samsonite Japanese I found out, but it didn't matter as I called downstairs. "Yes sir, come down, we can solve your problem." I went down, the bellman had a box, and in that box perfectly organized on boards, on hooks, there was a luggage key for every piece of luggage that I've ever heard of and most that I hadn't heard of. He gave me the key that needed. I opened the suitcase. The problem happened again on the same trip in London in a major hotel. First off, the bellman couldn't understand American, but he said, "Yes, I think we can solve your problem," He proceeded to dump a one cubic foot box on the desk. For an hour, I sorted through it and finally found a key that was close. Later, in Seattle, I thought I'd try the same experiment. I was told on the phone that I shouldn't bother to go to the desk, they couldn't help me. Before you laugh too much, let me tell you that I tryed the same thing here last night and no one answered the phone. Clearly, this little example indicates an attitude which may be as simple as "be prepared" manifested as behavior which we somehow now expect as the norm.

The Japanese people got to this point by deciding how they wanted to be and then managing the change necessary to make it happen. I think that as long as we continue to think about reacting or adapting to change, rather than managing change, then we're never going to find the right wave to ride. We're simply not going to do it.

We have to learn to stop adapting to change and instead deciding what we want the world to be like and then coming up with the program to manage that change. I think the French have just done that in the program which was described here earlier today. In the U.S. Government, it was decided three times in ten years to manage our change into a more productive nation. We had under the Nixon administration a thing called the National Center on Productivity and Quality of Working Life, or NCOP. Its idea was to demonstrate the benefit of productivity improving technology. Before anything got going, administrations changed and President Carter abolished the center. Carter, after two years, decided that there was a productivity problem. He started a program in the Department of Commerce called COGENT, Cooperative Generic Technology with nearly the same purpose as NCOP. Just about the time it was about to do its first good thing, it was abolished when President Reagan was elected. President Reagan, perhaps, learned a little bit faster than the Carter administration, because within his first year he started the Productivity Counsel. However, the first thing the leader of the Productivity Counsel did was to go to Japan to talk to the Janpanese about not shipping cars and other products to the U.S. Clearly, none of these programs went far enough to change the behavior of American manufacturers.

In the final analysis, the question of How Far Can You Go is an individual one. Let me offer, none-the-less, what I believe it is that we need to do to go as far as we can.

First: Decide how far and how fast we want to go. I really believe it's within our power to make that decision and if we stick with it we'll make the changes necessary to recover our way of life.

Second: Develop our own game plan and stick to it in spite of the criticisms that are going to come from those who insist on maintaining the status quo.

Third: Abandon the idea of instant turnaround. We have instant coffee, and instant glue. We want instant turnaround of multi billion dollar corporations, or we want, for the benefit of investors in venture capitol firms, instant success. We need to stop trying instant turn around. We need to go planned, measured, iterative, that is to say -- managed change.

Fourth: We need to start to reward the leaders. And I define the leader as being a person who can look beyond the action which is guaranteed to insure this years bonus. And instead, build a business with interests of the community, the company, and, most importantly, with their childrens' futures uppermost in their mind. Profits will come, but profits cannot be our number one objective or we will in fact not find them.

Fifth: I think that as managers and leaders ourselves, we have to begin to change our own behavior by starting to ask ourselves and our associates, both subordinates and superiors, why not instead of why.

Why not try,
Why not excel,
Why not persevere
Why not win and more

Again, thank you very much for the opportunity to speak with you here today.

## Management Planning for Introduction of Industrial Robotics

(Presented to National Association of Manufacturers annual policy meeting, Sheraton Washington Hotel, Washington, D.C., March 18, 1982, by Dennis E. Wisnosky, vice president, GCA Corp.)

Good Afternoon Ladies and Gentlemen.

It gives me great pleasure to meet with you today and to talk about planning for the introduction of robotics.

Let me begin by saying that planning in any technology area, particularly one that is emerging, is a delicate balancing act of sticking to a very long term strategy and being extremely flexible in siezing opportunities that from time to time just seem to pop up. Also, I maintain that success often comes from looking in places where others simply did not look at all. And, I would bet that ten years from now, while all of us sitting in this room will have robotics technology in place, in most cases it will not be doing quite the things that we are today expecting, and will be paying off in ways that defied today's ability to predict them. Using traditional approaches, things that turn out to be significant are most often not on the problem list at all. They are instead, most often, something new which is discovered in the process of doing.

Technology planning begins with a forecast. For a product developer such as a robot company, this forecast is an assessment of the market. In other words, what problems will how many customers want to solve during the next weeks, months, and years, etc. Next, the developer assesses capabilities required to economically solve those problems, and when - through development or acquisition - those capabilities can be brought to the market. For the robot customer, who has his own product to bring to the market, the process is done in reverse. The questioning sequence is, here are the products I want to

make, what problems will I have in making them, where can I find solutions to those problems. Success to both parties comes when the right solution meets the right problem at the right time. This is fairly easy when the technology customer is looking for incremental solutions. That is, a small improvement. It often becomes a roll of the dice however, when the objective is described in such terms as the "Automatic Factory of the Future" (FOF). Even though we all can now agree that this is the objective that we, as a nation, must have to regain our competitive position in world markets.

In my opinion, planning for even the seemingly most simple problem in moving toward this Automatic Factory begins with a global look at the characterics of the entire factory from the top-down point of view. Let me begin with what I believe are the three most significant characteristics of the Factory of the Future.

Efficient
Flexible
Effective

What is efficiency? Since the Industrial Revolution American industry has learned how to be efficient in a way unparalleled in the world. Simultaneously developing transfer lines and mass marketing and distribution to sell their output, we became known as both the producers and consumers of the world. Efficiency was fairly easy as long as people were content to limit their options. Henry Ford said that his customers could have "any color that

they wanted as long as it was black". The reason for that was his available technology. In fact, black was the only color that dried sufficiently fast to enable continuous production. In today's terminology, factories must not only be efficient, that is each operation is performed with the necessary speed, but they must also be efficiently integrated and continuous. Integrated and continuous then brings into the production scenario the utilization of no more material than is absolutely necessary and begins to eliminate the discontinuities in manufacturing which in many cases rob even the most efficient operations of the benefits which were designed into them in the beginning. In today's world, if manufacturing efficiency by itself is not sufficient to maintain competitiveness by its nature, it limits the ability necessary, to both direct and respond to constantly changing world markets.

Flexibility has to do with the idea of production equipment remaining economical in the face of change. Rather than thinking of units or parts per minute or per hour, such as with the most efficient transfer line technology, flexible automation is by definition reprogrammable to do a variety of different piece parts on the same production equipment. Humans are of course the most flexible workers on the factory floor, but today robots are taking their place as being the most economical flexible factory workers. The area of flexibility is where robotic technology really comes into its own. Here we can have the same reprogrammable machine utilized on a multiple purpose assembly line for example, where it is performing the welding operation on every car model that the manufacturer has. The robot controller only needs to be told the difference from model to model one time, and it performs

unerringly everafter never stopping to reset and never taking a coffee break. Most importantly, however, as production needs change, the robot can be reprogrammed, it need not be scrapped and new tooling bought. Thus our capital utilization is also improved over conventional hard, but efficient automation.

The third idea - Effectiveness, is perhaps the most important of the three in the long run and particularly from the human point of view. That is, tomorrows' factories must be effectively organized to do the right thing with productive and happy people.

In planning for the utilization of robots, a question about their acceptance by labor unions always comes up. It takes forms: (1) Robots will naturally replace people and there will be mass unemployment, (2) The few remaining workers in our factories will reject their steel collared partners. With respect to the first point, I ask you to ponder the dichotomy that there are nearly 250,000 American autoworkers out of work today and there are less than 2000 robots working in American auto factories. In this case, in my opinion, the problem is Japenese cars not American robots. Recently, a congressional task force spent considerable time examining the potential of the problem that robots may displace workers and concluded that robot introduction into the work place will be the same as computers in the 1950's. It will in fact add workers, not cause unemployment. We must naturally plan for re-education and training, or we will indeed have serious problems with the second concern - worker acceptance of robots. However, effective organization is much deeper

than worker acceptance of new technology. It has to do primarly with the idea of doing the right thing as opposed to the traditional American single mindedness of doing the thing right. An effective organization is one which recognizes both the need for functional specialization, such as manufacturing and engineering, but more critically recognizes that a relay race in which one team has the fastest runners but loses time in handing the baton off from one to another is of no more value than a team of slow runners. What happens when people lose sight of the need to do the right thing? A couple of years ago a well known book recounted the story of a major car company where the marketing department make a decision to introduce a massive marketing campaign for 4-cylinder engines in economy cars while at the same time the manufacturing department concluded that since cars with 4-cylinder engines were not being sold, it should immediately stop their production. In this particular case, sales were lost much money was spent, and there were many unhappy customers. Both organizations were very efficient in their decision making process and also negotiated management flexibility but neither decision turned out to be effective for the organization as a whole.

Are these three ideas of Efficiency, Flexibility, and Effectiveness mutually exclusive? Certainly not. In fact, thinking this way will almost certainly guarantee failure in planning for introduction of industrial robots. It is this very problem that is largely responsible for our present situation of not being able to compete with other industrial nations of the world, particulary Japan. While we have been preoccupied with either creating the most efficient production units in the world, such as Detroit's transfer lines or insisting

upon using people rather than automation, such as in virtualy our entire electronics industry, or catering to the often whimsical needs of rugged individualists demanding a rigid work place where an electrician must be called to replace a fuse; and where there is utter chaos on Monday mornings as workers bid for the weeks' jobs; and where manufacturing engineering routinely redesigns the products of design engineering because they cannot be built - our international competitors have integrated all three ingredients necessary to be successful in tomorrow's manufacuturing world. They have indeed combined efficiency with flexibility with effectiveness. The results are only too obvious to us today.

How did our competitors get this way while we literally languished in our respective ruts? I believe that we either consciously or unconsciously adopted a policy of adapting to change, while they adopted a practice of managing change. The difference is obvious. Adapting to change requires no plan at all, one simply goes with the flow, as it were. In managing change, either an individual or a firm decides what the world should be like, and then takes steps to make it that way. The latter approach does indeed require careful, thoughtful, and considerate planning.

Just how important is planning. I contend that if the policy is adapting, rather than managing change, it is probably not important at all. However, adapting to change, as history proves, seldom works, instead, managing change is the way to make continuous significant progress. Let me give you a historical example: the French built the Suez Canal after the English failed,

and the U.S. built the Panama Canal after the French, fresh from their Suez victory failed. In fact the French failed twice - why? Assume that all the participants had the same desire. First the British were almost bankrupted in building the Suez Canal. A sea level canal, that is, a canal that did not require locks. They did not realize the need for an essential ingredient - - the steam dredge. Without the steam dredge, it was impossible for manual labor to keep silt out of the diggings. The French were successful because they recognized the need for a new technology without which they would certainly have failed as had the British.

But, adapting that technology to build the Panama Canal did not work for the French. They failed twice, because of two problems. First, that the dredge did not work on solid rocks, and secondly, that malaria killed workers faster than they could be brought to South America from France. Thousands of people died from a disease whose cause wasn't ever found. Then came the Americans, three problems were recognized. One: there needed to be a cure for malaria, two: there needed to be a way to eventually move mountains, three: there needed to be a way to secure the rights to the shortest distance between the Atlantic and Pacific Oceans. Before the first rock was moved, the cause for malaria - mosquitos - was discovered, and quinine was invented for its cure. Two, nitroglycerin the basis of dynamite was invented in a totally unrelated event, but its need was recognized and it was then planned to be used. Three, a revolution just happened to conveniently occur for the United States whereby Panama was created from Columbia at exactly the place where the United States had decided that the Canal should be built. Panama of course immediately

granted the rights to the Canal zone to the United States in perpetuity. So it was, that two of the three ingredients necessary for success were managed to occur and the third was recognized to have occured. Put together, the project was a success which we still benefit from today.

The second example of managing change on a monumental scale occured in our own lifetime. With one statement, John Kennedy created the technology of microprocessors and launched us into the computer age when he said "...the United States will have a man on the moon by the end of the decade". He did not exactly say when or how, but set the wheels in motion for tremendous change to be managed over a period of many years, and of course we are still all benefiting from those changes today.

Let me conclude the theme of managing change by particularizing it to your introduction of robotics into manufacturing.

First, one must of course have a goal. I propose that it be the best combination of efficiency, flexibility, and effectiveness for your particular situation. Certainly I would not presuppose to say that it is an equation that is one third - one third - one third of the three essential ingredients, but I would say, that every solution, every successful solution, will have some combination of each, rather than be primarily geared towards one of the three.

With this out of the way, there are five additional elements with which we have to deal. The first is workers - system integration; or how the worker gets involved in the use of robots in the shop. This has to do with the job process, perceptual feelings, sensory feelings, communications, and control. The use of the robot must make the worker feel better about his job. This will occur provided that the machine is explained to the worker. It must be explained by looking at the workers specific environment, the interface the worker has with the robot, what the worker does in the performance loop, and does the worker have anything to do with making certain that the robot is doing its job. Secondly, education - does the worker have the opportunity to both learn and to improve the workplace. Is time allowed for a formal education process to not only teach the worker the new job, but also provide sufficient knowledge that the worker actually self improves the environment or makes suggestions for its improvement. In short, is there logical growth path for advancement. Thirdly, how we explain the change which will occur to the worker effects the workers acceptance. Is controlling data and documentation clear and consistent? How do we tell the people what it is that they are supposed to do? And how can we then tell that they have done it. If they do not understand then they truly can not be expected to care. Fourth, our own management attitude. And this is where the rub really is, I am convinced. We hide behind our reticence and often are more comfortable with maintaining the status quo than taking the effort to manage change. Technology change by engineers, without the corresponding organizational change by management will not only cause the robot application to fail, but the situation will probably actually worsen into a less productive situation than had automation not been

tried. Fifth, overall employee motivation and morale. Motivation and morale must be considered in each individual application of a robot, whereby the enthusiasm of the corporate level rubs off on the individual worker and in the process proof is provided that what they are being asked to do really does matter in the long run.

Where does all of this lead us? Certainly you have the feeling by now that we are not talking about quick solutions to simple problems. We should expect no less. Certainly the world that we have created took a long time for us to make it this way and our application of solutions should be expected to take no less time. However, if we accept the concept and philosophy of managing change rather than adapting to change we will all certainly feel much more comfortable in the process of change. This must be true because we will have a much clearer idea of whether or not we are still indeed on the path that we have chosen for ourselves.

With that, I thank you very much for your attention, and will be happy to entertain any questions that you might have.



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**news from:**

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For Release Immediately

D. E. WISNOSKY TESTIFIES BEFORE
HOUSE LABOR STANDARDS SUBCOMMITTEE

Washington, D.C., June 23, 1982 -- GCA Group Vice President Dennis E. Wisnosky recommended that government, academia and industry join together in joint productivity improvement programs to further the development of factory automation, in testimony today before the House of Representatives Labor Standards Subcommittee here.

Mr. Wisnosky said that to increase productivity, American industries need to "try out factory automation ideas in very, very big ways." By forming joint productivity improvement programs, the government will "provide seed money and leadership to create a climate where growth could occur -- economic growth and growth in the number of jobs."

American industries today must compete in a world market with countries that already have national productivity programs and are automating their manufacturing operations. "Automation is the one chance we have to compete -- let alone survive -- in the world market," Mr. Wisnosky said.

- more -

Mr. Wisnosky also recommended tax incentives for industries investing in manufacturing technology. "These tax incentives or credits should go beyond accelerated depreciation for capital equipment," he said. "Further, I believe we should even consider protection or direct subsidies for those industries experiencing unfair foreign competition."

Even if worldwide competition does not force American industries to automate, automation technology would increase employment and provide a better life for U.S. workers, said Mr. Wisnosky. Although automation will cause job displacement, Mr. Wisnosky likened the effect of automation on U.S. employment to that of the growth of the computer industry. "Back in the 1950s, we were warned that computers would cause mass unemployment. Exactly the opposite occurred," he said.

Rather than fight automation, Mr. Wisnosky said, "our unions should be demanding that a certain portion of the workers' time be dedicated to re-education and training. . . Retraining rights should be built into the wage structure, the same as vacations and other fringe benefits."

As his last point, Mr. Wisnosky endorsed the Stevenson-Wydler Technology Innovation Act of 1980. If funded, this Act would encourage technology transfer between government laboratories and private industry by establishing application offices to integrate new technologies into the private sector.

Mr. Wisnosky spoke in front of the Labor Standards Subcommittee during their hearings on the effect of new technology in the American workplace. Mr. Wisnosky is a GCA Vice President and Group Vice President of the GCA/Industrial Systems Group, and directs all GCA efforts in factory automation. He has had 15 years of experience in high technology and factory automation in government, academia and in private industry.

Mr. MILLER. Thank you.
Mr. Bittle?

**STATEMENT OF WILLIAM BITTLE, ECONOMIST, RESEARCH DEPARTMENT, INTERNATIONAL ASSOCIATION OF MACHINISTS AND AEROSPACE WORKERS**

Mr. BITTLE. Yes. Thank you, Chairman Miller, Mr. Ratchford.

I am an economist at the Research Department of the IAM, which represents over 800,000 workers in a variety of industries, including aerospace, air transport, machinery manufacturing, shipbuilding, electronics, and other high-technology industries.

Our membership is a mixture of skills. Currently, about 32 percent of these members are highly skilled craftsmen, with another 56 percent being semi-skilled production workers.

I welcome this opportunity to share with you the IAM's views on this important subject. In my submitted testimony, I have attempted to touch on our major concerns and activities with respect to technological change.

As an organization of workers, our focus with respect to technology is its impact in the workplace, and on the working person's life. Our activities with regard to technology are all aimed at insuring that what we view as an appropriate consideration of these impacts, and adequate protection of the worker's interests.

At the work place level we most deal with issues such as the effect on skills, dehumanizing trends in the design of work duties and factories, safety and health implications of technological change, and particularly with suitable provisions for retraining displaced workers, and access to that training.

Technological change in the work place is an ongoing phenomenon. And our most important concern is the continuation of sufficient employment opportunities. When it runs at its usual relatively even and measured pace, it can be dealt with reasonably well by the collective bargaining processes which have evolved over the decades, coupled with the social programs designed to ease temporary displacement in employment.

This is particularly true when the economy is expanding. This has basically been the American experience with technological change. In general, workers whose skills became redundant have been able to find employment relatively soon, either in the industries created by the new technology, or others, as the economy evolved from an agrarian to a manufacturing economy or later into an expansion of services.

This has generally been true, even when the pace of technological change has quickened, as it has lately, under the influence of the widespread adaptation of computers, silicon chips, and industrial robots to work place applications.

There is, in my view, an inappropriate tendency to generalize this serendipitous historical experience with technological change into an economic theorem to the effect that technological change creates more jobs than it destroys, because of the expansion of growth and wealth which it makes possible.

At the IAM, we do not feel reassured, look at this in the same light as the notion that since there has yet to be any major loss of

lives due to an accident at a nuclear power facility, current safeguards must be adequate.

And Congress is experience with the Reagan economic program is persuasive that it is not sufficient to provide the means or incentives of business expansion when business itself judges the longer-term payoff for such expansion as doubtful.

Such programs in fact, to the extent they are acted upon, because of the inducement provided, can only intensify the worker displacement problems, precisely because they do bring these labor-saving technologies into earlier application under motivations which are not based on an assessment of the dynamic factors present in the economy—not based on real opportunities for expansion and growth.

To sum up this point, since the Government has embarked on its massive program to stimulate investment in new plant and equipment, which obviously means accelerated applications of labor-saving technologies, I pray that good luck again will provide enough growth to soften the more brutalizing effects on workers. But I do not see these dynamics in our economy.

It is an economy that is no longer young, and an economy that now faces more economic competition throughout the world.

Further, the applications of technology now coming onto the scene will impact in all areas of employment, not just in record-keeping and office work, not just in processes of one or two manufacturing industries, but across all industries, manufacturing and nonmanufacturing, and into services. The implications of such an exciting transformation become frightening when you consider the resulting displacement if the economy does continue in its current no-growth mode.

As a nation, we simply have no programs or plans to deal with this possible eventuality. We need to come to an understanding that nothing replaces the loss experienced by an individual worker who sees the need for his skills disappear in the middle of his working life.

Even if he finds other employment within a reasonable time, it is usually at a lower wage level, perhaps in another geographical region, and after some period of economic uncertainty or hardship. This worker's plight must be considered and mediated, for he is not responsible for his situation. If there is failure in his plight, it is not his failure but rather failure on the part of his employer or of his society.

As a side comment I might add that in looking at the question of whether or not a job is boring or less valuable as a contribution to society or to the individual holding it, you might ask the individual who has the job, and I think his answer will often depend upon what other work might be available to him if he loses it. And that also needs to be taken into consideration. The necessity of earning a living is still what keeps most workers at their jobs, not the personal job satisfaction.

In our society, our thinking about personal worth, and our economic means of distributing wealth is still primarily determined by means of our work—that is, the position we hold. What means of distribution do we use when only a small fraction of the population is involved with the production of the goods and services that we

sell to each other? Through the years one of the continuing goals of the labor movement has been obtaining through collective bargaining, commitments by employers to recognize and assume their obligations with respect to employees displaced by technological change. While we have experienced some sporadic success, managements have generally been unresponsive.

Managements tend to think of these issues as being in the area of their prerogatives to operate the business, and to regard the assumption of obligations with respect to displaced employees as nonproductive expenses to be kept to a minimum, much in the same way that one might try to control a wasteful use of energy.

Also, too many employers see the application of new technology as a means to limit dependence upon the workers, whether or not this also results in greater production efficiency.

As you will note from the case study report prepared by Leslie Nulty of our staff, which we have submitted, the IAM's recent experiences where employers have been introducing new technology does not encourage us to think that management attitudes have changed in this regard. Many employers still successfully dilute skills, subdivide job duties, transfer work out of bargaining units, et cetera, all on the pretext that workers in the bargaining units are not capable of dealing with the complexities of the new technology. And they persist, even if in the face of evidence, that self-trained bargaining unit employees can operate new machines more efficiently than the formally-trained nonbargaining unit technicians the company has assigned to the new equipment. Such anti-union, antiworker attitudes are not attuned to the needs of these times, but unfortunately, they appear to be as pervasive as ever.

At the IAM, we have also found quality of work life programs, or so-called quality circles, which are being touted as a means of obtaining better cooperation between workers and employees and providing an avenue for workers to have input into management decisions, are more often being used by American managements as an opportunity to propagandize the employees and to circumvent the union as his representative on matters of wages and working conditions.

The unions' limited success in gaining management recognition of its obligations to workers results largely from the fact that management is only required to recognize us as representatives of workers currently employed—not those made redundant by technological change to the worker still employed these issues are seldom strikeable issues especially when times are good and employment is secure. And certainly management resistance stiffens when times are less secure.

In our view then the issue of the division of responsibility for displaced workers as between society or government on the one hand, and employers on the other hand, will ultimately have to be decided in a wider arena than that provided by collective bargaining. The issues of international competition force the accelerated application of new technologies, we are told, further, the regional impact of plant closings and relocations has implications of importance which cannot be adequately addressed through collective bargaining. Also there will be social problems resulting from questions of how to deal with those who will be displaced. All of these factors

add up to problems requiring the type of national attention which this subcommittee is providing today.

However, by having already established programs which encourage corporations to invest in labor-saving equipment, with certain goals in mind, and with specific predictions and assumptions regarding the impact of those programs on the economy and on employment opportunities within it, the Government already has acquired a greater obligation to workers who are, as a result, displaced.

The rate of application of technology in a particular economy is determined largely by conditions in that economy. The pace has been rapid in Japan and to a lesser degree in Germany, because of a labor shortage situation they have experienced.

It was their only alternative for seeking increased production. An economy having no labor shortage situation might more appropriately adopt a slower pace. And, in fact, the efficient use of resources might so dictate. We need not adopt a rapid pace of implementation simply to match that of Japan or some other world economy.

In fact, on the question of productivity, we need to remind ourselves, apparently repeatedly, that when we look at the figures, or talk about these numbers, that what is being measured is the "rate of increase" that is most frequently compared between one country and another, and not the relative productive efficiency of those economies.

Now, it is true that if the "rate of increase" continues over a very extended period of time to be greater in those other economies than in the United States ultimately, the result will be that our competitiveness will be diminished.

However, productivity changes are not short-term phenomena and what may happen in 1 or 2 or 3 or even 5 years is not necessarily that significant whenever the United States has such a great lead over the others—and still is the most efficient economy in the world.

In our view, what is needed with respect to all of the aspects of this very complex problem, is a real first commitment to full employment, not just an other attempt to encourage conditions that would produce full employment. Corporate decisionmakers must be "persuaded" to carry through implied—but not required—commitments when they accept government largesse.

Evidence is accumulating that where there is a real commitment to full employment, either—as in Japan—through the active employment of Government policy by requirements, restrictions, and obligations placed on employers, or simply by the voluntary adoption of that attitude by management, the adaptation of new technology meets more successful implementation.

This attitude, if real, means that new technology can then be viewed as nonthreatening to the workers, and they are thus free to assist in its effective introduction. If the economy is healthy and expanding, it will naturally occur that new work opportunities will develop, and the new benefits of technology can be enjoyed by all.

Indeed, with full employment, business would be encouraged to innovate, to introduce new technology, since there would be a market for their products.

In the absence of the commitment to full employment, however, rapid and thoughtless technological change can only exacerbate social problems, especially through the displacement of workers, particularly minorities and women who are just beginning to achieve job levels which permit them to enjoy the benefits of technology.

It is our belief that we must concentrate our attention on accommodating technology to people, and making it serve people. The potential for using technology to truly improve the quality of work life, to make work processes more interesting, not less, to make work more challenging and more satisfying, not less, is immense.

The potential for misusing technology is equally as great, and given the history of technological development so far, we are not too optimistic about the right choices being made. Clearly, technology is itself neutral. And the only question before the House is how we put it to use.

If employers are willing to sit down with the unions representing their employees, then they will find a partner. If employers recognize the labor movement does not oppose technology, but that we oppose throwing people on a scrap heap, they will find understanding.

If employers are frank and open and willing to listen, they will hear useful ideas from their workers. But if employers refuse to view worker adjustment costs as part of the cost of industrial innovation, the human cost, if you will, they will find resistance.

This resistance may only delay the inevitable, but the price in bitterness and confrontation is likely to be great, and the economic cost staggering.

Thank you.

[Material submitted by William Bittle follows:]

## Statement of William Bittle, Economist, Research Department, International Association of Machinists and Aerospace Workers

I am William Bittle, an Economist in the Research Department of the International Association of Machinists and Aerospace Workers (IAM), which presents over 800,000 workers in a variety of industries, including aerospace, air transport, machinery manufacturing, shipbuilding, electronics and other high technology industries. Our membership is a mixture of skills. Currently, about 32 percent of these members are highly skilled craftsmen with another 56 percent being semi-skilled, production workers.

Let me begin by saying that I welcome this opportunity to share with you the IAM's views on a subject which could well prove to be a major factor in determining the future shape of American society during the balance of this century. Indeed, today's new technology may have a more pervasive effect on human resource planning in the 1980's than any other factor.

Technological change has been with us since the discovery of fire and the invention of the wheel. In more recent decades, workers have had to adjust to constantly changing situations, as increasingly complex machines were introduced throughout the American economy. While for the most part unions have been quite successful in dealing with these changes, the quickened pace of current developments are cause for serious concern.

The widespread application of computers, silicon chips, and industrial robots, and the speed with which these and similar technological advances are being developed, portend vast changes in all segments of the workplace. Not only are traditional crafts and production jobs being transformed, but many white collar and professional activities are also being affected by the advent of the "paperless" office, computer-generated engineering designs, electronic teaching machines, satellite communications, and so on. In essence, our society is involved in a rapid and massive redesign of work.

As trade unionists, our concern over this "second industrial revolution" must be people and what this new technology does to people. I emphasize, "what it does to people," because the scientific community has more than enough resources to remind us what technology does for people.

Certainly there are countless benefits in the new technologies -- benefits which can and must be shared by all. Indeed, assuring that all share in these benefits is a responsibility of the labor movement. However, while modern technological advances have contributed enormously to the enhancement of our lifestyles, they are also taking their toll at the workplace. A new electronic device hailed as a timesaver by a plant manager may also result in massive unemployment. As machines become obsolete because of such advances, so do their operators. Highly specialized jobs which they are not trained to perform are often created. Manpower

requirements may be drastically reduced or perhaps eliminated entirely. This has resulted in a continual contraction of the rate of employment and has impacted on occupational requirements and caused occupational shifts.

The new technology has brought us about 1,100 known carcinogens in the workplace. New ways for workers to die from the benefits of new technology. Approximately 600 new chemicals are introduced each year, many with harmful side effects for the workers who produce them and the consumers who use them.

Technology has brought us the new health hazards of stress and stress-related illnesses unheard of during previous industrial revolutions. Further, amazingly little is known about stress. Much of the literature on stress relates it to middle managers and little if any is devoted to white and blue collar workers; e.g. the fact that forced overtime in a leisure-oriented society creates stress on families.

Concomitant with technological change has been the transformation of the U.S. economy from a production base to a service base. Where formerly we had thought of technological change as having its major impact on manufacturing, it is clear that such change is likely to accelerate in the service sector as well. The implications of such a transformation are frightening, especially when you contemplate who -- or what -- will produce the goods we will sell each other.

The time is now -- for trade unionists, for government, for industry -- to develop a strategy for dealing with technological change in a creative manner that minimizes injury, and maximizes the accommodation of technology to people -- and people to technology -- while providing the benefits of technological advances by creating a better world for all people.

The creative tool which we in labor bring to this process is collective bargaining. Through negotiation, employers and employees can develop those approaches that humanize both the workplace and the work itself, including the impact of innovation and new technology on workers' jobs, earnings and futures.

Much of what unions can do to protect workers from the impact of technological change depends on the contract provisions the unions are able to negotiate in this area. Each union has different problems and must develop different solutions for these problems.

Further, many of the collective bargaining approaches of today, are really not new or novel in that most of the specific issues raised by automation are familiar to most unions. For example, grievance procedures already exist in varying degrees in one form or another for dealing with these problems, and adjustments to automation will consist to a great extent on the extension of existing rules and practices in contracts.

The current rate and direction of technological change, however, indicates some need for imagination and challenging approaches that may go considerably beyond what is familiar from the past.

Obviously, the problems of automation cannot be completely solved through collective bargaining. Nonetheless, over the years the labor movement has taken giant strides through collective bargaining to cushion the impact of technological change and to enable workers to obtain their rightful share of those changes.

I should point out that the IAM's interest and concern over new technology goes back to, at least, the early 1960's. At that time, the IAM Executive Council set forward an eight-point program for combating what was then termed "automation." The program included such items as advance notice, layoff by attrition, rate retention, retraining, etc. Further, in 1969, the IAM set up an annual Electronics and New Technology Conference. The basic purpose of this conference has been to keep our membership fully informed on the latest trends and developments in new manufacturing technologies. In 1981, we produced an updated and enlarged set of contract language specifically designed to protect IAM members from the negative impact of new technology (Appendix A).

While providing strong contract language is a vital first step, it cannot be the sole answer. Workers must seek to obtain some control over new technology. This can best be done by gaining a say in what the new equipment is designed to do before it is built and brought into the plant and by getting a share of the greater productivity it creates through a "tax" on technology. The tax would, in effect, be a form of profit-sharing, using part of the increased profits resulting from productivity created by new technology.

In dealing with problems of this magnitude we must further recognize that they cannot be solved by unions or collective bargaining alone. Rather, government, industry and even the scientific community must join in the developing of social policies designed to make working people the beneficiaries rather than the victims of new technology.

As a first step in this direction, the IAM sponsored a Scientists and Engineers Conference held last summer. This Conference was attended by IAM shop floor members, a group of engineers from academia and a smaller group of professional engineers from corporate firms where we have collective bargaining contracts.

Out of that Conference, much of which was devoted to new technology, a New Technology Bill of Rights was proposed and is being circulated among our members (Appendix B). A summary of this Bill of Rights can be found in three straight forward declarations: new technology must be used in a way that creates and maintains jobs; new technology must be used to improve the conditions of work; and, new technology must be used to develop the industrial base and improve the environment.

It was the consensus of the IAM members participating in the Scientists and Engineers Conference that trade unions should not only adopt and proclaim the New Technology Bill of Rights, but that they seek full participation in the decisions that govern the design, deployment and use of new technology. In other words, we can no longer merely respond to unilateral management actions.

Following this Conference, IAM Representatives, along with others from the UAW, CWA and IUE, attended a two-week American-Scandinavian workshop on new technologies. In these nations, where labor has long been an accepted equal and partner in society, the trade unions are deeply involved in new technology from its initial development to its application in the workplace.

I must repeat, again, that labor cannot do the job alone. Innovation-caused economic dislocation and other kinds of dislocation -- including plant shutdowns caused by technology change, job loss from trade policies and production shifts away from defense-related industry -- require cooperative labor-management efforts and also national programs to deal with these complex problems. Further exploration is needed of a variety of such programs, including proposals dealing with plant shutdowns and plant relocation and reconversion of defense-related industry.

In establishing a national policy on technological change, a modest first, but vital step relates to the fact that much more information is needed on the effects of industrial innovation and new technology on workers. Federal action is needed to set up a clearinghouse to gather information on a continuing basis on innovation and technological change and its effects on the welfare of the American people, on jobs, skills, training needs and industry location. With more and better information, public and private adjustment programs can better avoid needless human hardship and suffering which too often result from the disruptive impact of changing technology and innovation.

Through this clearinghouse, the federal government could provide unions and employers with comprehensive information and service, upon request, to help the parties develop labor-management solutions from the complex problems related to the impact of innovation and technological change in the workplace.

We need to know more about and to monitor asiduously the export of technology. It may well be that our technology is our most important asset, our most important strength. We, as a nation, ought to take a serious look at the indiscriminate and unnecessary transfer of that technology abroad, most often by our multinational corporations for reasons of profit alone. We need to develop a measure of the desirability of such transfers from the standpoint of our traditional well-being in terms of its effects, not on profits, but on jobs and its effects on the American people and their communities.

National full employment programs must assure an economic climate in which collective bargaining can flourish. These national programs must help solve the social and human adjustment problems, created by innovation and new technology, which lie outside the scope of collective bargaining.

If the economy is healthy and expanding, new work opportunities will develop and the new benefits of technology can be enjoyed by all. Indeed, with full employment, business would be encouraged to innovate, to introduce new technology, since there would be a market for their products.

In the absence of full employment, however, rapid and thoughtless technological change can only exacerbate social problems, especially through the displacement of workers -- particularly minorities and women who are just beginning to achieve job levels which permit them to enjoy the benefits of technology.

As I stated earlier, we must concentrate our attention on people and accommodating technology to people and make it serve people. The potential for using technology to truly improve the quality of worklife, to make work processes more interesting (not less), to make work more challenging and more satisfying (not less) is immense. The potential for misusing technology is equally as great and, given the history of technological development so far, we are not too optimistic about the right choices being made.

Clearly, technology is itself neutral and the only question before the House is how we put it to use. If employers are willing to sit down with the unions representing their employees, then they will find a partner. If employers recognize that the labor movement does not oppose technology, but that we oppose throwing people on a scrapheap, they will find understanding. If employers are frank and open and willing to listen, they will hear ideas -- not bombast. But if employers refuse to view worker adjustment costs as part of the cost of industrial innovation -- the human cost, if you will -- they will find resistance. This resistance may only delay the inevitable, but the price in bitterness and confrontation is likely to be great; the economic cost, staggering.

Thank you

APPENDIX A

SUGGESTED LANGUAGE FOR
TECHNOLOGICAL CHANGE

The language provided below is intended to provide guidance for locals wishing to negotiate improved security language into their agreements relating to issues of technological change. The jumping off point for this effort was the already existing language recommended in the IAM Model Contract Manual. That language has been examined in detail by each of the two collective bargaining workshops of the 1981 Electronics and New Technology Conference. Changes representing improvements in protection have been incorporated in these revised recommendations.

A word of warning is necessary! This language does not represent an integrated proposal to be submitted "as is". It is instead, a setting forth of options and alternative approaches. For example, a bargaining unit which negotiated the language herein recommended relative to Reduction in Force Due to Technological Change, which provides only for reduction by "attrition", would then have no need, or little need, for language dealing with Rate Retention, Retraining and Transfer Rights and Relocation Expenses.

Therefore, in extracting language from this document for proposals to employers, care must be taken to insure consistent intent, without internal conflict between the items selected. Further it is necessary to examine how the selected clauses might dove-tail with or impinge upon the meaning of

existing contract language; especially language which already provides some protection (such as transfer rights of laid-off employees whether or not it was occasioned by technological change).

Finally, specific language must be tailored to the individual contract in many instances to insure that the new clauses do no violence to existing seniority and bargaining unit definition arrangements. We have tried to indicate where decisions of this type must be made by providing choices. However, since it is impossible to anticipate all variations of contract language, it is essential that each local determine the modifications necessary to maximize the effectiveness of these recommendations in each negotiating situation.

## What is New Technology?

Often the new technology is in place before the union is fully aware of what is happening. Thus, the first step is to reach agreement, in advance, on what constitutes new technology so that the rest of the program can begin.

Article ___.1

Technological change shall be defined as any alteration in equipment, material, methods, and/or changes in work design. This should also include any change in product line.

## Advance Notice

In the event of management's introducing new technology, it is imperative that the union firmly establish the right to advance notice, the right to certain kinds of information and the obligation to bargain over necessary adjustments through clear and specific contract language. By being required

to give advance notice of plans to introduce technological change, the union will have time to negotiate all of the necessary adjustment programs. Expensive automated equipment is usually ordered long before its installation. If management is required to inform the Union at the time the equipment is ordered, there would be ample opportunity for the Union and Company to negotiate in advance for the changes. Good-faith labor management planning, before the new equipment is installed, can eliminate hardships for workers and disruption in the plant.

Article___.1

The Company will advise the Union of any proposed technological changes prior to the time of the final decision, but not less than six months prior to institution of such change. The Company will promptly meet with the Union to negotiate regarding the effects of the proposed technological changes.

___.2

The Company shall be required to provide the Union with full information regarding the proposed technological changes in order to determine the effects on the bargaining unit. Failure to reach agreement during these negotiations shall eliminate any restriction on the Union's right to strike. The Union shall, at its option, have the right to submit any dispute arising under this Article to the grievance and arbitration procedure.

Joint Consultation

Since it is impossible to predict all of the negative effects of technological changes before they are incorporated, it is necessary to establish a committee of labor-management representatives to negotiate the impact of such changes. With a joint committee the Union can require information as to the consequences involved in the changes and negotiate adequate safeguards for the workers affected.

Article____.1

There will be established a Joint Union-Management Committee for Technological Change, comprised of equal representation from the Union and Management, to study the problems arising from technological change in relation to the effect on the employees in the bargaining unit. The Union shall be entitled to all necessary information relevant to the proposed technological change including any new or increased health hazard associated with the new technology. The Committee shall meet at the request of either party.

Reduction In Force By Attrition

If the introduction of automated equipment is carefully planned, the Union can avoid layoffs even when fewer workers are necessary for a particular operation. Layoffs have been totally avoided by allowing any necessary reduction of force to take place gradually as a result of voluntary quits, retirement or death.

Article____.2

During the term of this agreement, no member of the bargaining unit shall be laid off or downgraded as either the direct or indirect result of technological change. Any reduction in the work force made necessary by technological change shall be accomplished by attrition. The term "attrition" shall be defined as the reduction of the work force by such natural means as death, voluntary quits, retirement and discharge for just cause.

New or Changed Job Classifications

As a standard rule — in all situations of changed jobs — the question of eligibility, wage rates, and effective date for new dates is paramount. This is especially true when new jobs are introduced or existing jobs are substantially altered. Ignoring important changes in job content, management has frequently insisted on maintaining the existing classification structure.

In other instances, it has sought to destroy the boundaries between existing skilled classifications.

Further, management often seeks to use technological change to downgrade existing jobs and, consequently, their rates of pay. While "red-circle" rates have always been a means of protecting present workers' pay scales, this approach takes on special meaning.

Article___.1

In the event the introduction of technological change results in either the establishment of new job classifications or a change in existing job classifications, employees within the (department, bargaining unit, plant), shall be given preference to such new and/or revised work resulting from these changes in order of seniority.

_____.2

All new job classifications created as the result of technological change which includes any of the work historically and/or currently performed by bargaining unit personnel shall be considered as coming under the scope of the bargaining unit. All current job classifications in the bargaining unit which are changed as the result of technological change shall remain within the bargaining unit. Any new job classification created as the result of a new product line shall be considred as falling within the scope of the existing bargaining unit.

_____.3

Rates of pay for new and/or revised job classifications shall be negotiated but, in no event, shall the negotiated earnings of the revised job be less than they were prior to the technological change. All such negotiated rates of pay shall be retroactive to the date of the introduction of such new equipment or processes.

_____.4

Employees who are displaced or downgraded from their regular job classifications as a result of technological change shall suffer no reduction in their hourly rate of pay. Such employees shall continue to receive all general wage increases, cost-of-living allowances, appropriate skill adjustments, if any, and any other increases necessary to maintain their equivalent rate of pay.

Retraining

The language that play the most important role and gives the worker the greatest benefit to adjust to technological changes is that which affords him the opportunity to retrain for new jobs, preferably in the same plant where he is presently employed. When training is required, there are a number of details which can be translated into contract language. Every effort should be made to negotiate provisions for training employees during working hours at company expense and prevailing rates of pay with senior employees having a prior claim to training opportunities. Every effort should be made to make available to the worker the opportunity to acquire the added knowledge and skills to perform any new work introduced.

Training, however, must be examined within a larger context. There will be situations where either the new technology requires substantially fewer workers or present employees are not capable of successful retraining. In these cases, it should be the company's responsibility to train the employee for jobs not necessarily related to the new technology per se. These jobs may be within the existing facility or at other plants of the company or, as a last resort, in the community at large.

Article ___.1

When, as a result of technological change, new and/or revised job classifications are introduced into the bargaining unit, the company shall insure that employees will be given the opportunity to acquire the knowledge and skills necessary to qualify for these new and/or revised job classifications.

____.2

In the event, retraining for the new and/or revised job classifications is not feasible, the Company will provide the necessary training for job classifications not related to the new technologies. This will include training for jobs in other departments in the plant, and if necessary, for jobs at other Company plants.

___.3

If a job with the Company is not feasible, the Company shall then initiate discussion with appropriate representatives of state and federal unemployment and job placement agencies with regard to job openings and/or skill shortages in the community. Should such openings exist, the Company will undertake to provide the necessary training so that affected employees can qualify for these jobs.

___.4

The Company shall establish, at its own expense and during regularly scheduled working hours, an adequate retraining program for affected employees. During the training period, the employee shall be paid at the established rate of pay for the job classification held prior to entering the training program.

Transfer Rights and Relocation Benefits

To provide senior workers with the greatest possible protection against job loss, unions have sought to establish the right to transfer to jobs in other plants.

The right to transfer to other plants may have a number of variations. For example, it may be confined to employees who are laid off because of a plant or department shutdown or extended to employees laid off for any reason at all. Also, it may be limited, on the one hand, to new plants, to situations in which existing operations have been moved to a new location, or to all plants in a given area or community; on the other hand, an employee may have the right to transfer to any plant of the company regardless of its "newness", type of operation, or location. Employess who transfer may retain full seniority rights or they may retain only those rights based on accredited service. A prime prerequisite to transferring to a different area is the ability to pay for the move. Thus, transferred employees should be given moving expenses and other allowances.

Article _____.1

Any employee on indefinite layoff or who is subject to separation because of technological change shall have preference with respect to rehire at other Company plants where there are employment opportunities.

_____.2

Employees laid off due to technological change shall be given preference over individuals not previously employed by the Company, in order of seniority, for job openings at other plants represented by the LAM, provided that all more senior employees from the plant experiencing technological change have waived their right to transfer subsequent to employee notification of the technological change producing the current reduction in force. Such more senior employees as select not to waive their right to transfer shall have preference over those on layoff or who otherwise would be displaced by the technological change.

_____.3

For the first six months of employment, such employees will retain their seniority in the plant from which they transferred and be subject to recall in accordance with the seniority provisions of the collective bargaining agreement covering that plant. At the end of the first six months of employment, the employee shall have the option of continuing as a permanent employee at the new plant or returning to layoff status at the plant from which he transferred.

_____.4

Employees transferred to a new plant in accordance with the above procedure shall be entitled to:

a) Full credit for all seniority with the Company.

b) All wages and fringe benefits as provided at the new plant.

c) Reimbursement for all reasonable expenses incurred in relocating to the new plant.

NOTE: The effectiveness of the language will depend upon whether other plants of the Company are organized, if so, by whom and the contract language in effect at those plants. The transfer clause in the contract should spell out who can transfer and under what conditions the move to different departments,

plants and locations takes place. Transfer programs require a review of existing seniority provisions and the purposes of such provisions.

Seniority provisions which allow transfer only within an occupation or a department may not protect long-service workers when a particular department or occupation becomes obsolete or is phased out. The question becomes particularly important when an entire operation or department is seriously affected by technological change. Such problems have often led to revised seniority rules so as to provide workers greater protection in exercising job retention rights.

The question of seniority can involve difficult problems regarding the merger of departments, moving of employees to other plants of the Company or reducing the normal work force as a result of technological change.

The seniority unit is often related to the degree of interchangeability among the jobs, since seniority generally functions easiest in a unit where skills are relatively interchangeable. As specialization increases, the seniority unit often becomes smaller. The more specialized the seniority grouping, the less protection the employee has in case of technological changes in his work situation. A seniority unit that works fine for selecting persons to work overtime, or to set vacation schedules, may not meet the needs of technological changes in the work process.

The introduction of computers, tape controlled machines and other technological advances has served to aggravate the problem of erosion of bargaining unit jobs. In many instances, new technology not only has been used to eliminate many jobs, but the operation of the new equipment has been assigned to out-of-unit employees further infringing on the job rights of our members. All the improved benefits provided by our contracts are of little value if the jobs of our members are improperly assigned to out-of-unit employees.

Article _____.1

Technological changes which affect jobs in the (bargaining unit, department, plant) will not be used as a basis for changing such jobs from bargaining unit status to non-bargaining unit status. When a new job is introduced into the plant, or the content of a job is significantly changed as a result of the introduction of either new equipment, materials or methods which are normally within the scope of the bargaining unit, or they are combined with duties which are not normally within the bargaining unit, the resulting job within the plant shall be considered as clearly within the bargaining unit. The Company will furnish all information requested by the Union in order to make a determination as to whether in fact such changed job duties are within compliance of this provision.

APPENDIX B

A TECHNOLOGY BILL OF RIGHTS

Proposed by the International Association of Machinists and Aerospace Workers

-Preamble-

Powerful new technologies are being poured into the workplace at a record rate. Based on the expanding capabilities and decreasin cost of computers and microelectronics, new forms of automation will leave few workplaces or occupations untouched. Robots on the assemb line, word processors in the office, numerical control in the machin shop, computer aided design in the engineering department, and electronic scanners in supermarkets are only a few examples of the widespread changes that are taking place.

While such technologies offer real promise for a better society they are being developed in a shortsighted and dangerous direction. Instead of benefits, working people are seeing jobs threatened, work conditions undermined, and the economic viability of communities cha lenged. In the face of these unprecendented dangers, labor must act forcefully and quickly to safeguard the rights of workers and develo technology in a way that benefits the entire society. Key to this i proclaiming and implementing a Technology Bill of Rights. This shou be a program that is both a new vision of what technology can accomp and a specific series of demands that are meant to guide the design, introduction, and use of new techology. This approach is based on t following assumptions:

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This document evolved from a meeting on new technology sponsored by the International Association of Machinists in New York on April 30 and May 1, 1981

1. A community has to produce in order to live. As a result, it is the obligation of an economy to organize people to work.

2. The well being of people and their communities must be given the highest priority in determining the way in which production is carried out.

3. Basing technological and production decisions on narrow economic grounds of profitability has made working people and communities the victims rather than the beneficieries of change.

4. Given the widespread scope and rapid rate of introduction of new technologies, society requires a democratically determined institutional, rather than individual response, to changes taking place. Otherwise, the social cost of technological change will be borne by those least able to pay it: unemployed workers and shattered communities.

5. Those that work have a right to participate in the decitions that govern their work and shape their lives.

6. The new automation technologies and the sciences that underlie them are the product of a worldwide, centuries-long accumulation of knowledge. Accordingly, working people and their communities have a right to share in the decisions about, and the gains from, new technology.

The choice should not be new technology or no technology but the development of technology with social responsibility. Therefore, the precondition for technological change must be the compliance with a program that defines and insures the well being of working people and the community. The following is the foundation of such a program, a Technology Bill of Rights:

1. New technology must the used in a way that creates or maintains jobs. A part of the productivity gains from new technology can translate into fewer working hours at the same pay or into fewer jobs. This is not a technical but a social decision. Given the pervasiveness of new forms of automation, the former approach is vital. The exact mechanisms for accomplishing this--a shorter work week, earlier retirement, longer vacations, or a combination--ought to be a prerogative of the workers involved. In addition, comprehensive training must be provided well before any change takes place to insure that workers have the maximum options to decide their future. Moreover, new industries that produce socially useful products must be created to insure the economic viability of regions that are particularly affected by technological change.

2. New techonology must be used to improve the conditions of work. Rather than using automation to destroy skills, pace work, and monitor workers, it can be used to enhance skill and expand the responsibility workers have on the job. In addition, the elimination of

hazardous and undesireable jobs should be a first priority, but at the discretion of the workers involved and not at the expense of employment. Production processes can be designed to fully utilize the skill, talent, creativity, initiative, and experience of people--instead of production designs aimed at controlling workers as if they were robots.

3. New technology must be used to develop the industrial base and improve the environment. At the same time corporate America has raised the flag of industrial revitalization, jobs are being exported from communities, regions, and even countries at a record rate. The narrow economic criteria of transnational companies are causing an erosion of the nation's manufacturing base and the collapse of many communities that are dependent on it. While other countries in the world have a pressing need and a legitimate right to develop new industry, it is nonetheless vital that corporations not be allowed to play workers, unions, and countries against each other, seeking the lowest bidder for wages and working conditions. Instead, close cooperation among unions throughout the world and stringent controls over plant closings and capital movement are in order. In addition, the development of technology should not be at the expense of the destruction of the environment.

The implementation of a Technology Bill of Rights would obviously require profound changes at the collective bargaining table and in the political arena. Unfortunately, the swift introduction of

new technology won't wait until the proper mechanisms are available to deal with it.

The labor movement must seize the initiative. This means initiating and proclaiming a Techonology Bill of Rights for workers and the society and making this a central vehicle to mobilize union members, organize the unorganized, and involve the community. In this way, corporate America can receive advance notice that the introduction of new technology is no longer the exclusive perogative of management or an automatic process. Moreover, uses of technology that violate the rights of workers and the society will be opposed.

Instead of only responding to management actions, unions will seek full participation in the decisions that govern the design, deployment, and use of new technology. The goal will be machines that fit the needs of people rather than the other way around.

"Union Responses to Changing Environments"

(Paper Submitted by Leslie E. Nulty, Staff Assistant to the International President, International Association of Machinists and Aerospace Workers, November 5 and 6, 1981)

October 30, 1981

Case Studies of IAM Local Experiences with the Introduction of New Technologies

The International Association of Machinists and Aerospace Workers has a long and strong tradition of local autonomy and responsibility. At least perhaps 20% of our total membership is covered by national master agreements, and a large part of that minority is in the transportation sector (railroads and airlines). Thus, although our major industrial "jurisdiction" overlaps that of other industrial unions such as the IUE, UAW, UE, AND USWA, the internal form and function is somewhat different.

Because of the relative paucity of master agreements, the IAM has a system of industrial conferences and coordinated bargaining committees (for specific firms) at which representatives of the particular locals or districts meet to review the current state and outlook for the firm or industry and to discuss general strategy. Our electronics industry conference has been held annually since the 1950s, but by convention decision in 1968, was rechristened the Electronics and New Technology Conference. It is chaired by a member of the Executive Council and is the principal forum for addressing problems of technological change at the national level. Recommendations developed by the conference are transmitted through the union in a variety of ways: reports on the conference are made by participants at their regional staff conferences (which are attended by, among others, elected business representatives who are the first level of full time

staff), the union newspaper covers the conference and the Grand Lodge (International's) Research Department uses conference recommendations in responding to requests for specific information or assistance that come in from the field.

In addition the Research Department prepares a manual of model contract language for all full time staff. This manual has had model language on the subject of technological change since 1960 (current model language is attached as an appendix). And although not couched specifically with reference to technology, the union's Constitution has included language on the related question of work rules and the proper jurisdiction of the union, since its early days. More recently, acting upon the recommendation of the 1981 Electronics and New Technology Conference, the union newspaper now carries a regular column on the issue.

In preparing the case studies that follow for this conference an attempt was made to reflect the enormous diversity of industries and firms organized by the IAM. Unfortunately, due to time and other constraints, there is one major omission, namely aerospace. Hopefully it may be possible to complete a study in this industry prior to publication. The cases were selected and pursued on the basis of experiences aired at our Electronics and New Technology conference, other conferences, and from the experience of our Research Department in aiding locals who have contacted them for support in negotiations on the issue of technological change.

This is of course a historical study, an attempt to determine how our locals have coped with technological changes experienced in

the past ten years. For them, the fully automated plant or machine shop is still something they read about in magazines or hear about from experts at our conferences. Their own experiences are largely incremental.* Moreover, as indicated in the following studies, specific contract language governing the introduction of new methods or machines was not available to any of the locals covered. Language governing training rights varies considerably. Transfer rights, severance pay, relocation allowances were not relevant in any of these cases (although they have been important in other IAM experiences). Instead the locals studied have been able to use informal information networks, language governing the definition of the bargaining unit, job descriptions, their own intrinsic skills and knowledge of the work process and finally the grievance procedure, as levers to insure that technological change is not the unrestricted province of management.

Whether these tools will be adequate for the scale of technological change that is projected for the next decade is another question. None of the stories told here is "over" -- they are all part and parcel of a continuous process of negotiation and response. New developments occur with almost every "follow-up" phone call. And there is certainly no way of predicting how successful the locals in question will be in fulfilling their determination to improve contract language in their next round of negotiations. Indeed, the impression one gets is that

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* The aerospace study may be different. Most of the developmental work on computerization of manufacturing and design and their integration has been carried out by the Department of Defense. This plus a cost-plus non-competitive market environment, has enabled defense contractors to go farther and faster than civilian industry.

this is one of the most difficult areas in which to get improved contract language, because it is so difficult to make it a strikable issue when the changes are incremental. Moreover, these stories reveal that in many cases management is prepared to go to quite extreme lengths -- to actually cut into its own potential profits -- in the effort to reduce the power and influence as well as sheer numbers of manual workers. If unions and their members are to come out ahead in this age-old struggle, it is clear that they must have as wide a range of strategies and tools at their disposal as they can possibly create, including the task of unionizing the draftsmen, engineers and computer programmers, with whom many of our members are or will be competing for work.

Case 1. The Introduction of Computer Numerical Controlled (CNC) Machine Tools in a Small Specialty Shop

I. Background

The firm in question is a privately-held family-owned firm that dates back to 1865. The IAM organized the workers in 1946 and since that time has remained the exclusive bargaining agent. There has never been a strike at the plant and a union shop has been a part of the agreement since the first contract.

IAM membership in 1981 stands at 89, working two shifts. Almost all are skilled or semi-skilled workers. Peak membership was 125, reached in early 1979. Major layoffs occurred just after the settlement of the current contract, in April and August 1979. No new workers have been hired in the past three years and people with less than five years seniority have never been recalled. Although there is a strong apprenticeship clause in the contract, no new apprentices have been hired in the past four to five years.

The 1979 layoffs appear not to be directly attributable to the introduction of CNC machine tools, which had been brought in in 1975/76 and 1977/78. Rather the cutbacks were a result of declining orders, largely attributable to the combination of heightened competition and shrinking demand, conditions which presist today. [Public waste disposal/sewage systems are an important market for the firm and that market, highly sensitive to federal funding for such activities, has been steadily declining]. At present there is one CNC jig mill, one CNC shaft lathe and two CNC chuckers. A new jig mill is expected shortly.

II. Workers' Control over the Production Process.

The contract clause designated "The Union and the Company" gives management complete discretion over the introduction of new machines, but members have been able to acquire advance knowledge of such decisions because of good working relationships and informal social contact with the substantial white collar/technical workforce (approximately 30 designers, computer programmers, engineers, draftsmen etc.) who are not in the IAM unit. Thus, the union role has been finding ways to adjust to an equipment mix and workpace designated by management.

At present, members' strongest asset in responding to new equipment is the combination of their high skill levels, the specialty nature of the product and their strong contract language covering job posting, bidding rights, and company training. The contract obliges management to look first to workers from the existing labor force for training for new vacancies, skills or machines. In the past this has meant that helpers were able to become machine tool operators and machine tool operators with sufficient seniority learned to operate and understand virtually all the machines in the shop. This in turn enabled them to acquire knowledge and skills equivalent to that of a journeyman machinist with formal apprenticeship training. Such workers could bid for top-rated "machinist" slots within the bargaining unit, but unlike the beneficiaries of apprenticeship training, they would not be able to walk into "machinist" positions with other firms. This pattern and practice apparently stopped six or seven years ago, with management announcing that only machinists who had successfully completed a state-certified apprenticeship program would be eligible for "machinist" rates.

Under the current local contract, members who bid and are accepted for training for a new job have a 90 day qualifying period during which that employee may choose to return to his former job. If he fails to qualify on the new job, he is guaranteed his old job back. This contract provision has meant that the individual worker has had the right to "try out" the new machines and reject them, in favor of his former job.

And indeed there has been significant experimentation of this sort. As a result of this experimentation it appears that older workers, accustomed to manually controlled machine tools, are far less comfortable with CNC machines than younger workers. In at least one case, a journeyman machinist took a pay cut in order to gain experience with the new generation of machine tools, only to find that the lack of control and very much higher machine speeds were not to his liking. He returned to his old higher paid classification and former job. Apparently this happened often enough that management has already given notice of its desire to change the contract so that a bidder on a new job would have to hold that job for a year before having either the right to bid on another or to return to his former position.

Concession on this issue would certainly limit the individual's ability to choose among jobs according to his own preferences. Given that there is a much greater degree of mental stress associated with CNC operations, it is not clear that such a change would in fact benefit management. The very high speeds of CNC machines (three to four times that of standard machines) require enormous concentration in a specialty operation such as this, in which expensive alloy castings are machined to fine specifications. Forcing workers who are not

comfortable with that kind of work to do it for a year would seem to presage potentially expensive errors and employee discontent.

The new CNC jig mill expected to arrive shortly will raise a new issue. This machine, the workers have learned through informal conversation with foremen and engineers, does two jobs simultaneously. The worker sets one job up, while the other is being machined. The current contract has no specific language on manning requirements and it is not clear how workers will be able to respond to this form of speed-up.

III. Health and Safety.

Unfortunately management has shown little ability or inclination to think through the many ramifications of CNC use. CNC machines were first introduced when order delivery times had reached two to three years and excess demand for pumps had brought new competitors into the field. Thus the immediate motive was to increase production rapidly. (Increasing the workforce at the time would probably have required building a new plant — a much lengthier undertaking). But with the high pressure to get the product out, management established a policy and pattern of virtually no preventive maintenance and of running the machines at the highest possible speed. Not surprisingly this led to equipment failure and expensive downtime. After two or three years management has apparently learned that the maximum is not necessarily the optimum. So the engineers have reduced the "standards" — the designated machine speeds for each type of material and part that is given to the production workers. However, the workers use their knowledge

and ability to reprogram machine feeds and speeds to get the job done as they see best; not necessarily according to the engineers' standards.

But the absence of preventive maintenance remains and contributes to the stress of working with machines that may fly apart or throw off the workpiece without warning. [The president of the local actually had the guard glass of his CNC lathe shatter in his face when the CNC machine threw off the piece on which he was working]. Yet all suggestions by the workers that better maintenance might lead to better production has been shrugged off by management (and remember -- we are talking about $350,000 machines bought with loans at 18-20%). In the members' own words, "You know -- workers are the lowest form of animal life."

Although the potential risk to the workers' safety seems to be greater with CNC machines, in fact the injury rate on standard machines is higher. This is because virtually all standard machines in this shop are unguarded -- a condition which invites a formal OSHA non-compliance citation. Recently however, workers' complaints have prompted management to begin building some guards.

Experts in the safety field are not aware of any formal rigorous comparative studies of the health and safety conditions associated with standard vs. CNC machine tools. But the plant management themselves suggested that CNC machines were probably noisier because of their higher operating speeds. And this in a shop whose noise levels are already quite high.

The only noise monitoring workers are aware of has been done by the company's insurer. The workers were never informed of the reading

but say that the shop always did seem especially quiet on the days the insurance company's inspector came round.

IV. Skill Effects.

The introduction of computer controls in machining operations is not seen as skill dilution by the workers. Indeed, management readily asserted that it makes sense to train a worker for CNC operations, only if that worker has extensive prior experience with standard and/or NC machines. IAM members operating CNC machines in this shop were trained by the machine manufacturer and, as mentioned above, are able to edit and change the computer program for speeds and feeds. But they also work closely with in-house programmers when (as often happens) the computers create errors in their own programs. All the traditional machining skills are essential to be able to spot and correct such errors.

Postscript

As this was being written, workers learned via the grapevine and local media (only the white collar employees had been formally notified by management) that the family-owned firm was being bought by a large sophisticated multi-plant corporation. They fully expect many changes in the work patterns and relationships described above and are quite worried about their leverage in contract negotiations coming up in six months.

Case 2. Robots and Computerization: Different Implications for Toolroom Workers

I. Background

Confronting a "mature" market -- slow long-run growth -- and one that is severely depressed at the moment as a consequence of the state of the housing market, this large major appliance manufacturer (one of the strongest conglomerate multinational corporations in the world) is moving rapidly to upgrade its manufacturing operations through robotics and computerization.

At the industrial complex in question, there are roughly 300 IAM tool and die workers, while another industrial union represents the 14,000 production and maintenance workers. Total employment at present stands at 19,000 -- down from its 1973 peak of 22,000. Six separate product lines are built in six separate buildings, each one of which has its own tool room.

The first production line robot was installed 10 years ago, to remove plastic parts from their molds and transfer them to a fixture on a machine which trimmed the parts. This original robot was set off in a fenced off area and used by the company as a kind of "show piece."

Five years later three(?) robots were brought in to do spray painting and glueing -- the most undesirable jobs. These were jobs held by people with the lowest seniority who bid out of them as fast as possible; in other words, low skill, high turnover jobs. Today there are 60 robots in use in these operations (with one exception

described below) and the company expects to have 90 in place in early 1982.

About one year ago a robot was installed in conjunction with a new punch press on the production line (i.e., not in any tool and die shop). The robot/punch-press combination was used by the company as a prototype to gain experience with how such systems work. The week of my interview with the local union president, the company began modifying existing punch presses to work with robots they have on order.

None of the maintenance and repair work on robots, with the exception of replacement or repair of tools and fixtures that are part of the robots, is under IAM jurisdiction. Although disagreements do arise occasionally between the IAM and the union representing the maintenance workers, these are generally settled amicably and there have been no problems in allocating new work associated with the new machines, between the two unions.

II. Employment Impact of Robots.

Because the tool and die workers' responsibilities are confined to the replacement and repair of tools and fixtures, robots have had little significant impact one way or the other on the amount or kind of work they have to do. The employment impact falls largely on the unskilled production workers. Indeed, in the most recent and currently projected rounds of layoffs, there will be no layoffs of toolroom workers. In 1980, when 3500 people were laid off (all of whom were called back within six months), no journeymen toolmakers were laid off, only apprentices. (This was a mistake, in the eyes of the IAM local, because

the company has difficulty hiring tool makers and was behaving in a short-sighted manner in delaying its apprentices' progress). In layoffs currently scheduled by the company for the final quarter of this year, no toolroom workers, including apprentices, will be affected.

Over the longer run the company has told the unions that it anticipates a permanent decline in the operation's labor force of 20%, as a result of the market outlook for its products (nothing explicit was attributed to the introduction of robots). And indeed current production is so far ahead of demand that final inventory is being stored in boxcars, warehouse space having been exhausted. The company expects to achieve the projected reduction in jobs through attrition and through some as yet unspecified program of retraining and placement.* This is not of major concern to the highly-skilled tool and die workers, however, because of their awareness of a general shortage of toolmakers in the area. They believe the company is likely to avoid laying them off temporarily for fear of losing them to other firms.

Thus, to the workers in the tool room, the amount of work associated with robots, as with any other type of machine, is largely a function of the size of the operation — how many machines are in use and how frequently their tools and dies have to be changed. But the amount of work to be done does not have a direct relationship to the number of tool room jobs. Those appear to be related more to the kind of work done in the tool room.

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* In recent months, for reasons the union has not yet been able to determine, the company has adopted a new "line" of worker involvement and paternalistic concern for its employees' well-being. The union is now waiting for "the other shoe to drop."

III. The Job-Creating Potential of CNC Machine Tools

Three months ago the first CNC machine tool — a milling machine — was put into operation in one of the tool rooms, and more are expected to be installed in the five other tool rooms in the complex.

Tool room workers have two very different kinds of responses to these machines. One group looks at the superior speed, quality, reliability, etc. of these machines and is concerned that there will be fewer jobs for tool makers.

Another group believes that the superior performance creates the potential for staunching the subcontracting of work out of the unit.

Thirty years ago, when the facility was first opened, all new die-making, the heart of the tool and die makers' craft, was done in-house. Within a decade this work began to be subcontracted out to other firms (some unionized, even by the IAM) and some non-union subsidiaries of the parent firm. In either case the result was that tool room operations at this plant became confined to fairly routine replacement and repair work.

Now most of the machinery in the tool rooms is 30 years old, and there are powerful forces encouraging even further subcontracting to more modern facilities where it may be possible to get the work done more cheaply. With the current slump in the market and competitive pressures intensive, this may appear more and more profitable to management. Workers hope that the addition of state-of-the-art machine tools will make it more attractive to the company to retain current work in-house and eventually go back to the production of original dies — work they consider to be far more creative, interesting and therefore, desirable.

The current union contract gives the tool and die workers a good lever for exploiting this possibility. The contract includes a special "farm-out" agreement, negotiated two years ago, which requires joint union-management discussion of any proposed subcontracting of "work normally performed by members of the bargaining unit on existing production tooling." It provides for a "show cause" report by management and a prohibition against any subcontracting challenged by the union until that challenge is resolved. Resolution can be accomplished either through satisfactory negotiations, or that failing, accelerated grievance procedure (i.e., it goes immediately to the step preceding arbitration). However the company has the right to implement the proposed subcontract once the grievance procedure has been invoked.

IV. Workers' control and skill development.

Thus far the workers have not experienced any problem with management attempting to restrict their knowledge or responsibilities vis-a-vis the CNC machines, but of course they are still in a training period.

The workers themselves have been able to decide the system for selecting who shall get training on the machines first. (Only eight people can be trained at one time.) They themselves decided to suspend the usual seniority-based selection system in recognition of the fact that the highest seniority people would be retiring in the next few months and therefore their training would be without purpose.

Instead they held a lottery -- and excluding those few about to retire, got 100% participation from the membership. The training classes are four hours long and include training in computer language

and programming. Those who are participating in the training report that it is serious and challenging. Training time is paid at straight time rates.

At first the members were worried that they would be excluded from programming knowledge, because of reports that the company had done this at other locations. This has not yet happened at the training level, but how things will evolve when the computer programmers begin to assert their jurisdictional claims, remains to be seen. (There are already computer programmers at the site, not in the bargaining unit, working on computer-aided-design). IAM members' awareness of this possibility has however made them determined to seek appropriate language in their contract during the next round of bargaining to assure that they maintain control of the programming function.

Case 3. New products and new jobs: protecting the union's jurisdiction

I. Background

In the early 1970s this division of a giant multinational conglomerate signed an agreement with the IAM local in question covering all plants in the greater metropolitan area.* Since that agreement was negotiated the value of the division's output has more than doubled, employment and IAM membership has more than doubled and the number of plants covered by the agreement has increased from three to six. Although this is not a union shop contract, membership has averaged 90-95% of the eligible labor force. This membership growth has been achieved in spite of job-displacing automation in many of the operations (electrostatic painting, automated test equipment, automated assembly and CNC machines in the machine shop) and new product development which has meant a decline in the share of total output for those jobs in which IAM membership was originally concentrated.

Over the past ten years the local union leadership has been keenly aware of the future implications of technological change and shifts in products and markets, even to the extent of attending industry conferences to learn about and keep up with new developments in the field. As described below, the diligence and persistence of the local leadership in policing the contract has enabled it to overcome many impediments to membership growth that might otherwise have gone unnoticed. Throughout the decade the union has repeatedly discovered manufacturing operations

* The company agreed to this in order to get the union to agree to change from an incentive pay system to measured day work.



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ancillary to existing operations, being carried out by the employer in unmarked facilities, and occasionally with workers hired through a middleman and designated "independent contractors." Through persistence and sophisticated bargaining, the union has ultimately been able to get these people and their work brought in under the contract umbrella.

II. Responding to new products and "new" jobs

Within the last five years two major changes have taken place in the existing operations. Work on a new line of advanced equipment began roughly five years ago. New assembly procedures were introduced for both old and new products two years ago.

The union was never informed about the introduction of the new product line. On its own it discovered the developmental work being done on it, in an unmarked rented plant in an industrial park, far from the original manufacturing complex. When the union brought this to local management's attention, and pointed out that its contract covered all operations in the metropolitan area, management said that union recognition would be granted when the work had progressed beyond development to actual production. And indeed one year later, when the first relatively simple components were brought into the main plant for assembly, the IAM did win jurisdiction over those jobs.

Shortly thereafter, production of a more complex precision component was brought into the main plant. The people assigned to this work were a mix of low skilled "independent contractors"* and highly

* These were young people hired right out of school and paid by the contracting firm at about $1.50/hr. below the lowest paid union worker. They have no seniority rights and are subject to termination at will. Although they have not been able to prove it, because the corporate chartering records on file with the state are incomplete, the union suspects that the contractor may be a shell, set up by the corporate employer.

skilled people, dubbed "lab technicians," holding 2-year degrees in analog and digital circuitry with course work in microprocessing. One year later, roughly one year after the union had discovered the "developmental" plant, and with the issues of bargaining unit work being done by non-unit workers having been repeatedly raised by local leadership, these sub-assembly jobs also came under the IAM contract.

At about the same time, construction began on a new facility to house all the final assembly and staging work on the new product. "Staging" is one of the most technical and highly skilled aspects of the entire operation: it is the term used to describe the final linking up of a complex system of components. Up until two years ago this work was usually done out in the field, in the actual place where the machinery would be used. It was done most frequently by locally-based service staff employed by the corporation. But occasionally workers from the production plant were flown out to do this work. In recent years, however, customers have been anxious to get these systems operating as soon as possible and have been less and less willing to accept delays resulting from insufficient field staff to do the staging. Thus customer pressure led to the staging function being carried out at the manufacturing site prior to shipment.

In the view of the IAM local, staging work belongs within the bargaining unit, but thus far the company has restricted it to "lab technicians" (approximately 200 in number) not in the unit. Having introduced a new task, the company argues that the work should not be under the union's jurisdiction because union members have never done the work before. The union argues that when this work was done in the field union members

did occasionally do it and that in any case they certainly have skills and ability equal to the task. The "lab technician" skills and other qualifications used in "staging" are virtually the same as those of the top-rated bargaining unit classification. The pay is the same, the two groups of workers get the same kinds of work orders and have the same relationship to engineering staff. But "lab technicians" working conditions are far superior.

They do not have to punch time clocks, have more independence and lighter supervision, do not have to meet daily production quotas and enjoy more liberal sick leave policy. Moreover these workers benefit from advanced training in the computer systems component of the final product -- training the company has thus far denied to IAM members. Having no specific contract language governing training rights, the local has used other means to lay claim to staging work.

Although the IAM's claim that "lab technician" work properly belongs within the bargaining unit has not yet been satisfied, continuous progress is being made. Two years ago, when the company failed to provide requested information on the numbers of "lab technicians," their responsibilities and job descriptions -- information essential for bargaining on the issue -- the union filed an unfair labor practice charge (refusal to bargain in good faith). When the company offered to compromise, and acceded to bringing the "contractor" jobs into the bargaining unit, the charge was dropped. This experience has shown local leadership that the company is very uncomfortable with having the issue come before the NLRB. The union is convinced that it has a strong case, if it should choose to ask the Board for unit clarification. But it has preferred not to take that ultimate step as long as there is continuous progress towards expansion of the unit. Negotiations on this issue are carried on almost weekly. This strategy has thus far proved to be successful in maintaining membership growth and unit strength.

Case 4. Company Willingness to Incur High Costs to Reduce Worker Control: Computerization of Parts Fabrication in Aircraft Maintenance and Repair

I. Background

In January 1980 a computer-controlled parts fabrication machine was brought into the shop in the aircraft service section of the home operations base of a large domestic airline. The fabrication shop produces parts in-house for aircraft maintenance and repair. The workers in the shop have traditionally had complete responsibility for producing the parts according to engineering specifications. Each worker has been able to handle each request "from A to Z," operating all machines in the shop.

There have been no recent layoffs in this shop but the number of workers has been reduced by five by attrition. As described below, the introduction of the new machine has meant that work traditionally performed by union members in the department has been transferred out and assigned by management to non-union members in the computer programming department. This has occurred even though there is no apparent technological or efficiency rationale for doing so. Indeed efficiency, profitability and other supposed management criteria for decision-making, point in the opposite direction, that is, towards more functions and responsibility being brought into the fabrication shop.

The workers in the fabrication shop are highly skilled people with considerable seniority. Their shop is part of an enormously larger complex — total IAM employment at the home base is around 5500.

Moreover, the union local is part of the national complex of locals in other cities that negotiate with their employer through the airlines district to which they all belong. The officers and staff of the district handle all negotiations, grievances processing etc., under a union shop agreement that has been in effect for over 40 years.

II. Workers' Control

The machine in question is an automatic turret punch press that produces batches of parts from sheet metal. The computerized control system can be operated either via taped programs or from programs introduced directly by the machine operator.

Prior to the machine's installation, workers in the shop bid for membership in the "machine crew" that would be trained to run the machine. When a mechanic and salesman came down to show the workers how to use the machine, which is unlike any other in the shop, the workers learned that the manufacturing company provided, free to purchasers, a two-week school to teach the purchaser's employees how to operate and program the machine. When the shop workers requested that they be sent to this school they were turned down, although the airlines company sent a supervisor, an engineer, a programmer and an electrical shop foreman. The shop workers were told that programming training was not appropriate for them and that it would take a computer programmer two years to become proficient in writing programs for the machine. They interpreted the company's attitude as implying that they were incapable of acquiring the necessary skills and knowledge.

The workers immediately filed a grievance, because, in their words:

> "something was wrong with a system that sends everyone involved with the equipment to school except the four people responsible to operate and maintain it eight hours a day...
>
> A grievance was filed because we began to realize that we were being deliberately kept away from the information required to do our job."

In their view, well-supported by actual experience as described below, it is impossible to separate the functions of programming and production. They see the company's attempt to do so as a violation of that section of the union contract that defines the union's jurisdiction as covering "all work involved in ... overhauling, repairing, fabrication ... and machine tool work in connection therewith." Instead the company chose to allocate part of that work to white collar people outside the bargaining unit.

In the meanwhile, two of the members of the machine crew, having been denied access to the formal training course, took the machine manuals home at night and taught themselves how to program the machine manually. Not only did they become proficient programmers with only six months of self-study -- they actually discovered errors in the manufacturer's manual that the computer programmers learned about from "errata" corrections conveyed to them by the manufacturer.

Four months after the machine had been installed, and during the period that the grievance was being processed through the first three steps, an on-off switch was installed by parties unknown on the computer as a means of curbing the worker's ability to control and program the machine. Needless to say, this was a minor, easily-overcome impediment for experienced machine shop workers. But it is seen by them as part

of a pattern of constant harassment and pressure carried out by a variety of means to keep them from running the computer end of the operation. The company has attempted, through the posting of printed procedural rules, to divide the work between white-collar programmers at the other end of the airfield and mere machine loading and unloading in the fabrication shop. Workers were given strict orders not to do any programming themselves but to work cooperatively with the computer programmers to help them get the errors out of their programs.

Management's goal of separating the two functions clearly violates the principles of the machine design. The manufacturer's manual states that

> "Programming is the process of analyzing an Engineering drawing, selecting an order of punching, and transferring this drawing information in the selected order to a program sheet. The program sheet becomes a basis for preparation of a program tape ...
>
> Evaluation of the Engineering drawing, selection of a machining sequence, and preparation of the program sheet is done by a programmer. The programmer must have a working knowledge of machine shop practices, blueprint reading, tool design, and sheet metal fabricating techniques. A good background in mathematics, especially trigonometry and algebra, is desirable."

All of these skills, abilities, educational requirements, etc. characterize the shop workers -- but not the company's computer programmers, who lack "working knowledge of machine shop practices and sheet metal fabricating techniques."

The workers themselves have clearly demonstrated that management's view of the appropriate division of labor is inefficient and entails enormous financial cost.

Under management's scheme a parts order that comes into the fabrication shop requiring the operation of the CNC turret punch cannot

be filled until the shop puts in a request and then receives a computer tape from the programming center. If the tape proves to have errors in it, or if the machine introduces errors (which happens), the workers are not supposed to do any editing, but are supposed to call in the programmers to straighten things out. All this leads to a turn-around time for filling a request for parts of a week or more. Moreover, lacking the production knowledge of the shop workers, the programmers write programs that are less efficient in the use of materials, leading to very expensive scrappage rates. As shown in Exhibit A, the workers estimate they can produce a given part at 6%, a mere fraction, of the cost when done management's way. And this doesn't even count the cost of the inefficiencies of long turn-around time.

The workers estimate that if they had full responsibility for programming, with the computer programmers on call as specialized consultants, they could get some parts orders in and out the door in a couple of hours, as opposed to a week. Moreover, if they had in their shop the tape printer and the plotter that are now available only to the programmers, they could reduce the costs and increase output even more.*

The workers in this case are especially embittered because several years ago, when the company was on the verge of bankruptcy, union members voted for wage concessions with the understanding that members would be made whole when profitability improved. In the first three years following that agreement, union members got back more than they had conceded. But last year (when the machine was brought in) and this year, under the combined impact of deregulation and the PATCO strike, the company has shown losses, obliging the workers to give up a percentage

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* This would also return the pattern making function to the machine shop workers, who lost it when CAD came in.

of the pay to which they would otherwise be entitled. Now they are faced with management intransigence that obviously works to depress profits and they can't understand it.

Management's method of introducing the CNC machine has also created friction among the union workers in the shop. Those workers not on the machine crew, now must take the rough parts stamped out by the CNC punch press (a machine they have not been trained to use) and are "reduced to" bending, deburring, etc. someone else's work, rather than doing the job "A to Z" as had been the system prior to the arrival of CNC.

At the same time management told the CNC machine crew to teach the other workers how to load the CNC machine (tapes, punches, dies and sheet metal), how to turn the machine on and off, but not how to program the machine. This contravenes the machine manufacturer's manual which states that safe and economical use requires "the operator to be thoroughly familiar with the system prior to use of the system." Management's order means that the workers doing the training are not allowed to answer many of the questions the trainees ask. Violators of a foreman's direct orders can incur a letter of reprimand, loss of pay or loss of his or her job.*

These sorts of management decisions have obviously injected a totally unnecessary element of stress into the workers' daily work relationship -- and one which would not be present if the machine manufacturer's instructions were followed. To the workers involved, the total picture is filled with grim irony, to say the least. The firm in question has made a lot of noise about labor-management cooperation

* Although the union would not permit such discipline being imposed on this issue, the threat of conflict is another source of pressure on the workers.

and management's interest in workers' productivity-raising suggestions. Yet at every step of the grievance procedure thus far invoked, the workers' complaints have been denied and their suggestions for improvement have been ignored and resulted in petty harassment.

The grievance is now at the final step -- arbitration. But there is a backlog of 1000 cases also at that step (largely because the company has adopted a policy of denying most grievances at the earlier stages, and the union has to give higher priority to discharges and pay complaints). So considerable delay is inevitable.

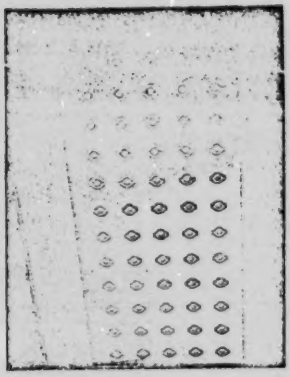
One of the workers has gone so far as to write to the CEO of the company (several months earlier he had cornered him on a flight and laid out the whole story) protesting the "cold war over control of the machine operation." But in the meanwhile, frustration and disillusionment with not being allowed to develop their skills or improve output remains.

EXHIBIT A*

Program P 100 171

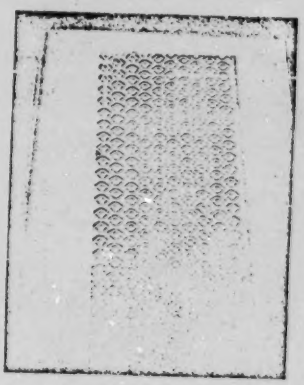
Mat. Cost $2.70 per sq. ft. (26 SH 802)

YOUR WAY



| | | |
|---|---|---|
| Sheet Size | 18 x 40 | |
| Programmer's Time | $25.00 | (2 hr.) |
| Time Share Comp. Cost | $250.00 | (5 min.) |
| Program Yield | 65 parts | |
| Material Cost | $13.50 | |
| Unit Cost | $4.43 | |

OUR WAY



| | | |
|---|---|---|
| Sheet Size | 18 x 40 | |
| Mec. Time | $36.00 | (3 hr.) |
| Manual Input | $12.00 | (1 hr.) |
| Program Yield | 250 parts | |
| Material Cost | $13.50 | |
| Unit Cost | .25¢ | |

Mr. MILLER. I thank you. One of the problems, and you have heard me already speak to it this morning, is being able to justify, I guess, the two positions here: the need and the desire of increased automation, whether it is office or factory, and the accepted viewpoint that this will simply lead to greater employment opportunities.

And what disturbs me a little bit is, I see a technology to some extent that is, in fact, designed within the production process for the purposes of eliminating the human input into that process, without placing any value on it, it is simply a fact that you can handle white-hot forgings with the robot easier, better, what have you, than you can with an individual.

I see these two parallel suggestions, sort of like when I first came to Congress, there was a strong push by the utilities, suggesting that, absent a 7-percent growth in energy, there could be no positive growth in the gross national product of this country, and the fact that we have found out that by better management of energy, you can, in fact, create a positive gross national product in this country and many others.

And, so I just wondered if the theorem is, in fact, widely accepted that this simply—we are not going to experience widespread unemployment or lack of employment opportunities in the future.

Is there a ratio of jobs created or displaced with one of your average placement of robots? You indicate at one point that some 10,000 jobs were created that were not there before, and I just—how do we measure this? How do we start to measure? We have obviously been told, earlier this morning, that currently we are not doing very well.

Because that has severe ramifications for policy considerations.

Mr. MUNSON. You are absolutely right. I will hazard a response.

Mr. MILLER. It is a cumbersome question.

Mr. MUNSON. It is a cumbersome question, but I understand it, and it is a very difficult one. First of all, let me put a couple of things into perspective, if I can. As far as the robot itself is concerned, it has been projected that the industry in this country will grow to $2 or $3 billion in 1990, at an annual growth rate of 35 percent.

Now, if you take—you can juggle figures all over the place, but just to try boil it down into something simple, with those numbers, you could be looking at perhaps 180,000 robots by 1990. Maybe more like 100,000, which, based on projections of the manufacturing work force at that time, of maybe 18 or 19 percent of the working population, that will be less than 1 percent, if it is 1 robot per person.

Now, it is likely to be two people would be displaced by a robot, either by the task it performs on a one-shift basis, or because it is working two shifts. But it is still a relatively small percentage of the total population, not to be ignored, but still small, looking at this 10-year timeframe.

The fact of the matter is, though, that certainly in the full scope of automating the factory and the workplace, with robots and other devices, I think there will be a larger number of people displaced.

But now, let's take a look at what is happening——

Mr. MILLER. Let me just stop you there.

Do you include in that, as you pointed out in one of the processes of the elimination of scrap, or 85 percent of scrap, obviously, robots combined with computerization have substantial impact on inventories. The steel industry is not excited that you have eliminated scrap or the aluminum industry, or the copper industry, which do various components that you might be working with, nor the steel workers, perhaps.

Yet, you can't argue with the goal of making the process more efficient and less costly, and the product, in theory, cheaper. But are you talking about those kinds of ripples, because we know that the changes in the automobile itself, of going to different materials, forget the robots, just simply looking for a lighter, more efficient automobile, is reduce the demand on steel.

Mr. MUNSON. Well, this is my next point. The fact is that if you look at it at the economy, and at the health of business—first of all, labor content is a small percentage of the total cost of manufacturing.

Second, the rationalization of the workplace through all these different technologies does lead us toward the elimination of in process—or reduction of in process inventories that cost money, floor space for them that costs money. It gives an overall, much more coherent and manageable factory environment in terms of the data that is fed back for decisionmaking.

The entire process becomes more efficient; reduced scrap, reduced energy, because if you make scrap, you may have to incur remelt costs or something of this sort; product quality; product liability; and in fact, speaking strictly from a supplier of robots point of view, the economics that are plugged in today to the determination as to whether to buy a robot or not is looking almost entirely at labor displacement or replacement, or elimination, without regard to these other factors that after the fact prove to be much more overwhelming in terms of economic benefit.

Mr. MILLER. Which ripple back through that particular chain, unrelated to the person you sold it to, back through that entity, suppliers or purchasers or people who service that industry.

Mr. MUNSON. If you introduce efficiency overall, you have a much more cost-competitive situation; you can generate, obviously, higher profits, and hopefully, management would be intelligent enough—and that is a big if—to reinvest for the long haul in improving his operations, and I believe, thereby improving the workers' situation as well.

Mr. MILLER. Well if that comes to fruition, and that would be the desired goal, it seems to me, of an economy that desires to stay competitive, that you would want to engage in the manufacturing process which has those attributes to it.

Let's not deal with unemployment for the issue in the sense of displacement, but in terms of the creation of job opportunities a decade from now, 25 years from now, the growth, I guess would be the term.

It seems to me as you start to cross-pollenate, if you will, between the office of the future, the factory of the future, and everything in between, those job opportunities, I just don't see that they can be created to——

Mr. MUNSON. I would like to mention two other things, because they came up earlier, too.

First of all, by the way, I think that I do share many of the thoughts here about the attention that has to be paid to the human condition of the worker.

Mr. MILLER. That is the second question. We are going to go into that one.

Mr. MUNSON. But I am firmly convinced—all right, we will leave that for later, but I am firmly convinced that what we are talking about will generate new jobs and new job opportunities within the factory, first of all, there will be a certain percentage of people who are placed in much more gratifying, challenging positions, and this has already occurred.

It has occurred, and you can get chapter and verse on that with officials from the UAW, in minor numbers directly related to robots, because robots are still minor numbers, OK? But it has occurred.

As far as—it was mentioned earlier this morning that the results of the first Industrial Revolution, mechanization and automation that have created new jobs and industries and all, may not necessarily be the wave of the future.

I disagree with that, because I think, you know, when we all read Dick Tracy many years ago, with the wrist radio, we didn't believe it for a moment. George Orwell, in "1984," his book, he made 137 predictions, 100 of which came true by 1975, and he didn't mention robots once, so what did he know?

Perhaps one of the things that has—and this was referenced earlier this morning—that one of the objectives of this committee's work is to help or find the means to identify these new industries and products, what these products will be?

Now, that is really crystal ball gazing, but it is going to give some indication of where the training requirement will come from, and where the people will be employed in the future. But those jobs will be generated.

Mr. MILLER. Let me just—it still seems to me that there is an inconsistency in this process, because, in fact, technology is designed at the elimination of the job, in the sense of the human being standing in position either in an office or in the factory, being in a position to interact; that as you view, I mean, you have one generation of robots, and you are already thinking of a second and a third generation, as are your competitors.

In each and every case, it is a further refinement of the process which has as its goal, it seems to me, is the elimination of that job. I am not placing a value on that, but I am just trying to determine the——

Mr. MUNSON. May I suggest to you, Chairman Miller, that we are all suffering from a problem of semantics, and how we perceive things? Because, perhaps we dwell too much upon job elimination. We are seeking better ways and better methods.

Mr. MILLER. I understand that.

Mr. MUNSON. OK, now, the fact is, yes, we were an agrarian society, because we had people with hoes in their hands. Then we mechanized that process.

Now, was it done primarily to eliminate people? Well, maybe that was a perspective, but what was really the result? A much more productive society, with a much higher standard of living——

Mr. MILLER. I am not arguing with you.

Mr. MUNSON. Doesn't that address the point, though?

Mr. MILLER. There is no question. But I can also take you to the Central Valley of California where there are no longer towns, there are no longer small businesses, there are no longer service industries, and we can plow from sunup to sundown, and you couldn't find enough people with hoes in their hands to deal with the agri—far more productive, and can't really argue with the results in terms of its impact on the standard of living in the world.

And I am not trying to place a value on whether or not your technology or the technology of IBM or others is going to replace it. I am trying to start to quantify, what, in fact, is or is not going to take place in your judgment? That is all, I am not passing value on it, but it seems to me that whether you say it is to streamline and improve the process, or it is to eliminate jobs, the impact is there.

Mr. Yamasaki is building a far different plant than somebody in that business would have built yesterday.

Mr. WISNOSKY. That is right. He is building it because of the fact that he needs to be competitive or even those 10 or 15 people that are left in that facility won't have jobs.

Mr. MILLER. No question.

Mr. WISNOSKY. That is just the way that things are going. I think that there is really a short-term——

Mr. MILLER. But the opportunity—again, the job opportunity that would have presented itself in the factory turning out that product, absent the technological change, would have been greater in number than will be presented there.

The reasons for that are, as you say, competition, cost and the fact that you—that product will even be salable in a market.

Mr. WISNOSKY. Did you say that the job opportunities will be greater in number the new way or the old way?

Mr. MILLER. The actual job opportunity in that factory——

Mr. WISNOSKY. Are different.

Mr. MILLER. Are different?

Mr. WISNOSKY. You could say that. They are different, but the jobs are still there, and I used—because I have spent a great deal of time over there in the course of my business life, in Japan. Then, as an example, many times in their mechanized or automated facilities, you don't see people, but where you do see people, are setting up those kind of operations, doing manufacturing engineering, doing design engineering, making certain that in the event that there is a breakdown, there are spare parts there ready to fix those machines.

It is true job displacement, not job elimination. Looking at the overall equation, then, of improving efficiency, they are able to reduce costs, and they are, then, able to export the products with those reduced costs, and then they need to increase production, and then they need more automation and more people, whereas we seem to have been doing the opposite for the last 20 years.

The short-term solution to this is, it seems to me, must be either to do what I don't see anybody advocating, and that is to abolish

the free trade system that we think we are in, or to match the competition with the tools we have today.

It seems to me to be the only choice we have, short-term. Longer-term, the answer to it, when the equation, and when looking at this thing gets extremely fuzzy, we should get ourselves in a position again where we can do what we did for the first part of the Industrial Revolution, or the second part of the first Industrial Revolution, and that is reduce the work week, go back to some of the things that the unions have had to give up lately, like 6 weeks of vacation and some of the other fringe benefits.

We should be able to—we must overcome the short-term problem. It is short term. Otherwise, nobody goes back to work. Get people back to work, and then we can turn our attention toward the finer things in life again. Right now, it is a struggle out there, and I don't know of anyway to reduce that struggle, except to use the tools that we have at our disposal that have proved to be effective for our competitors.

I am using——

Mr. MILLER. I really feel like I am passing in the night, and maybe it is my ignorance of the subject, and that is why there will be a lot more hearings, but in terms of attempting to quantify so you can make those decisions, all three of you have recommended, as have others, a role for the government.

But the real consideration is what would that role be? Because if you tell the government you are going to saddle us with a 4-day week, that is one set of criteria. If you tell us you are going to saddle with a reduction in job oppo tunities, that is another criteria.

I mean, that is what I don't understand yet. I don't understand how we will be able to quantify the impact on what you are suggesting. I mean, I appreciate what you are saying, look, if Detroit doesn't change, or other industries aren't competing, in the short run nobody is going to back to work.

Yet I am also told that as those changes are brought about, as new factories are built, that perhaps 250,000 auto workers won't go back in that industry at all. They will go somewhere else. That is what you call a displacement problem, apparently.

But, I just—I have trouble determining to what extent that will be—you are very confident in your testimony that that is all temporary——

Mr. WISNOSKY. That what is all temporary?

Mr. MILLER. That there will be employment opportunities in the long run for all.

Mr. WISNOSKY. There will be employment opportunities in the short run for all, also, provided that we begin now to apply the automation technology that we have. We have already seen in the past 5 years that when other countries apply that automation technology, there are a lack of employment opportunities for our workers.

That is what we are experiencing today. Do you agree with that point?

Mr. MILLER. Well, there are those in this country who would charge that they have maintained their employment opportunities by dumping, by unfair competition, by government subsidies, or

you export people back out of Germany, or you dump your product out of Japan onto this market.

So I don't know if those are real employment opportunities, long term, of whether they are subsidized short term false in appearance.

Mr. WISNOSKY. So you are saying another way——

Mr. MILLER. I don't know, I don't know. No, no, no. I am suggesting to say that Japan invested in technology now that Japan has full employment. It may also be that Japan is dumping tea sets, electronic equipment, and steel and automobiles on the America market, subsidized by the government.

This is the government that is abandoning subsidies and abandoning that role. West Germany is involved in technology, therefore it has full employment. We also knows that it brings in a good number of workers across its border, and also asks those people to leave when times get tough. That is not yet a policy in this country.

So I am trying to determine, first of all, what is the hard-core job opportunity; what is the hard-core growth; then you can make these other determinations, if you so desire, about training, retraining, leisure time, an immigration policy, Government subsidies and all that.

Because maybe these industries in Japan aren't quite as efficient as they have made out to be if, in fact, they have to dump a product. Something must be wrong.

Mr. WISNOSKY. I haven't said whether or not they are——

Mr. MILLER. Those are the kinds of considerations, but before you get there, it seems to me you have to determine what is the baseline from which we are operating.

Mr. WISNOSKY. What we have just described is a very, very complex situation, the same one that I described in my testimony. And then, looking at that complex situation, it seems to me that you—one could spend one's time trying to quantify every aspect of it, or, picking out some aspects that seem to be reasonable to work on, that are based upon past experiences that have been good, and applying some of that same kind of medicine, which I think is what we are talking about here now.

The other parts should not be ignored. And it is not going to be only the Labor Standards Subcommittee that should be the Government agency that begins to help us all to turn it all around. You certainly have a piece of it.

Mr. MILLER. Well, it is of concern to me if there is no real structural unemployment problems in the near-term, if we just invest in technology, and everybody can go back to work——

Mr. WISNOSKY. No, I didn't say it was that simple.

Mr. MILLER. That is one set of problems. If there is only a short-term displacement problem, then I am better off taking a look at the educational establishment in terms of the long-term educated population to take their place in the American economy.

If there is, however, a long-term displacement problem, I must look at the questions of retraining.

Mr. WISNOSKY. Sure.

Mr. MILLER. What are adequate or inadequate? But you have to have some hints as to what will take place and what won't take place.

Mr. WISNOSKY. Back to my major point again, we have had a lot of negative hints as to what takes place if we keep on doing it the way we have been doing it. There are a lot of reasons people will give, including the price of money and the cost of money and everything else.

We have tried a couple of times, as I have mentioned, to get our hand around some things we have taught other people to do, like with the NCOP and the cogent program, only to name two that I had personal familiarity with.

And neither time did we stay with it long enough. It seems to me that it may be more important to pick something, anything, and stay with it, if we can all agree that it is more positive than negative, than it is to continue to think about the problem.

Mr. MUNSON. I don't know if I have any answers, but, you know, two things: First of all, the automotive industry will never be the same. Let's understand that.

Mr. MILLER. Clearly. What is the meaning of that statement?

Mr. MUNSON. What that means is, first of all, it will never be as big as it was at one time, relative to the population, OK?

Mr. MILLER. Are you talking worldwide?

Mr. MUNSON. I am talking about this country.

Mr. MILLER. This country.

Mr. MUNSON. Because part of our market share is eroded forever? Second, I happen to think that there——

Mr. WISNOSKY. I don't accept that particular statement. I like to think that we can get back what we once had.

Mr. MUNSON. That is your opinion. I am saying it is going through a very serious adjustment, and it will never be the same—you know, it was headed toward 11 million per year, and never made it, as a percentage of the population——

Mr. MILLER. If it went back to 10.5 or 11 million, or let's say 10 million, that would be the goal today. Everybody would be happy with 10 million units. If it went back to 10 million units, it would not go back with all of the people who are currently sitting on the bench in the halls.

Mr. MUNSON. I don't see how it could.

Mr. MILLER. OK.

Mr. MUNSON. I don't see how it could, both from the standpoint of cost as one factor, and quality as another. And there is something to be said for automation relative to quality. And I am not saying that people cannot do it, but they cannot do it consistently.

We cannot expect people to do—if we had hours, I could show you chapter and verse where that can't happen. But that is one observation.

The other one is, I pose a question, I am searching for what you are searching for, where do we go next? How do we get some of these answers? What did happen to the steel industry? Technology.

There is no doubt that, I think in anybody's mind, that—now, what were the forces that drove—and I don't like to always be using Japan as the example. That is a society that is much different than ours, but nevertheless, happen to dedicate themselves to

developing technology with no natural resources, and do it more effectively.

I don't know how much dumping they are doing in these different areas, but I don't think they are doing a hell of a lot of dumping—excuse me—but I don't think that the economy could survive if they were doing that en masse.

Mr. WISNOSKY. Certainly not for 20 years.

Mr. MUNSON. Right. I haven't given you any answers, but I think some of the questions are posed that we have to look at, but I believe that basically what we two are saying anyway, is that—I don't think I agree with Dennis on what can happen in the short term—but certainly in the long term—if we have got to create an atmosphere in which we will invest in technological advancements for the long haul.

Now, I will say one more thing. There has to be some other incentives generated by Government for the private sector to invest. Dennis alluded to this.

Mr. MILLER. There is not much left for the tax, there is not much more we can give back.

Mr. MUNSON. That is true. But it is something we have to look at.

Mr. WISNOSKY. That is just the incentive. It is to give it back. It doesn't say what it should be given back for. And it seems to me that it should at least hint in that direction. That is important. There are those of us who will do it the right way, anyway, and then there are those others that have been described by others as short-termers, and they don't do it that way.

Mr. MUNSON. That is the problem; is that our mentality is short-term profits, right from the board room.

Mr. WISNOSKY. Not yours and mine, everybody else's.

Mr. MILLER. Right.

Mr. MUNSON. But the fact is that in some of the investments that have to be made, that should be made, are not being made, is because of that short-term view. We have equipment in this country that is 20, 30 years old, whereas the average age of equipment in Japan, to use that as an example, is under 10.

Mr. MILLER. Well, I understand that. But, again, that policy consideration, and I don't want to pretend like this committee is going to make all these determinations, but at least one member is going to get a vote, and so when we talk about accelerated depreciation, there are those who will argue among them that it should have been targeted for specific purposes and technologies.

To Mr. Bittle's constituency, what you have now is the situation where you have simply placed a value on the eradication of the job, without the consideration——

Mr. WISNOSKY. No, no. You only said half of this statement. It should be for particular technologies, for a particular purpose, with the same incentive being, or the same carrot there being for retraining the worker in another area. Or how about the son of the worker, if the worker is about to retire? Think about that aspect of it as well.

Don't look at it—we are a systems-oriented culture, except when it comes to the most important thing that we are dealing with here, the system of industry, government, and education. We then

seem to think about them in pieces, and we even subdivide that into more pieces.

Mr. MILLER. If you will, both of you are suggesting, and you are suggesting the desire for, far more governmental involvement than certainly this administration is prepared to undertake, more than we have ever undertaken certainly in recent times.

Mr. WISNOSKY. Recent times may be the last year or two.

Mr. MILLER. No, I would say the last 10 years.

Mr. WISNOSKY. In the Chicago Tribune about 2 months ago, there was a writer that wrote that the way to solve the problems we have right now, is to reduce the wages of the workers. I wrote him a letter back, which I also sent to Dennis Chamot saying that I thought that that was absurd. The workers didn't create this problem, management did.

And certainly, if we are going to reduce the wages of workers, it probably should begin with people like the newspaper reporters, and presidents of companies. And I never got a response, but then in last Sunday's paper, he wrote an article that I could just as well have written, because he advocated that it is time that we all got together and sat down long enough without yelling at one another to understand what it was we are dealing with and if the Government emerges as the leader of that new way of doing business in the world economy, then that may be what it takes to get back to the standard of living that we were once heading toward.

Mr. MILLER. But you obviously are engaged in at least this period of time where that is the opposite of a philosophy——

Mr. WISNOSKY. It is another short term thing that we are doing. And it may, in fact, be necessary, short term. It may have already reduced inflation, the rate of inflation. It may be bringing interest rates down, but is this style where we want to be in 1997? Or 1987, even?

Mr. MILLER. Well, I am trying to conduct this without passing value judgments on various aspects of the problem at this moment, or the solutions, but it is inconceivable to me how you can move in the direction that the three of you desire, and the previous panels desire with basically Government being left out of the equation. It is inconceivable to me whether you like the—some people like the Japanese role model, where Miti makes a decision that ceramics are where we are going, or photovoltaic cells, and makes this kind of contribution, seed money contribution, research and development, and whether or not you adopt a policy of lifetime employment, which I am sure is far overblown in the Americans' mind about how many people in Japan participate in the so-called lifetime employment.

But those kinds of decisions—that would be my personal suggestion. That is why I am so concerned about the basis on which those kinds of decisions to involve Government in various parts of what I think ultimately should be some kind of partnership is of concern to me. So that if it is done, it will be done properly.

Mr. BITTLE. Well, I think we would like a better partnership, too, but I don't think we can let pass the notion that the Government isn't already very much involved in all of these decisions, and only tries to pretend that it isn't. The whole economic package that has been passed so far has an impact, that it encourages the invest-

ment in new plant and equipment, and if it does work, it is going to have an impact on bringing about these changes at a more rapid rate than otherwise might occur.

Mr. MILLER. Well, I guess I would disagree a little bit with that, because when I talk about Government being involved I am talking about what I think are serious, conscious decisions, and I am not sure that the economic package of last July was a serious, conscious decision.

Mr. BITTLE. Well, I could agree with you on that. I would hope that you are correct.

Mr. MILLER. And there seems to be a diminishing amount of evidence that, in fact, it has attained the goals of the rhetoric that surrounded it, and so that is the kind of policy decisions that are made affirmatively through the expenditures of money or discounting of revenues and tax policy that I would hope to avoid.

Mr. BITTLE. But the intention——

Mr. MILLER. Because I think that revenue package has simply set us back in the goals of the related industries that we have heard from this morning.

Mr. BITTLE. But the intention was there in the way it was proposed and what it intended to accomplish, that it would have had an impact on all these subjects that we are discussing, so the Government is deeply involved in all of these questions already, it is just trying to avoid responsibility for some of these decisions it has made.

Mr. WISNOSKY. Maybe the simple way of saying it is that the Government involvement shouldn't involve legislation and regulation, it should involve leadership. Somebody has to do that.

Mr. MILLER. Well, we have got 535 candidates for the post. But it, in fact, does involve legislation; it does involve those kinds of choices in terms of an allocation of governmental resources or national resources.

You know, I have talked to a number of people in this field who project out in their mind and various reports have obviously been done on substantial percentages of our population not being engaged in long-term employment or in dramatically reducing workweeks.

And what that suggests to me, somehow, is that there is going to be some kind of continued redistribution of income, then maybe one of the more serious problems that confronts us in this, if that is true.

In your scenario, that may not necessarily be so.

Mr. WISNOSKY. There already has been. That is right. It wouldn't be so, because I am saying that there already has been redistribution of income, and it has been from the layoff funds of unions that were accumulating to paying out to them. And the subbenefits, and all that kind of stuff, which is all redistribution of income, for no good purpose whatsoever.

So we have had it, the raw end of it, and I wouldn't begin with the assumption we can never get back to where we were, but I would say we have got to do better than we were, and that says, let's look at it from a positive point of view, not a negative point of view, and make sure the redistribution is the way that we planned

for it, given that all crystal balls are cloudy, but the ones that we have been using in the past have been completely dark.

Mr. MILLER. Well, thank you very much for your patience and time with—at least with one member of this committee, because I think that this hearing this morning has raised that whole series of issues that, in fact, must be resolved. You have suggested in your testimony they be resolved now, and get on with it.

And I don't know if that is the situation, but as was said earlier, I don't think that we are going to hold back these advances, nor should we. Nor should we even try, but I think there is some very serious questions that were raised by the previous panel that have been raised by Mr. Bittle and others in organized labor and in consumer groups as to the manner of integration.

You know, I find it very interesting that on the eve of one technology and on the sunset, if you will, of another, that we introduce quality circles to consider the workers in this process. That I find that it is an interesting transition from—I think it was the chairman of your board, or the president of your company that talked about what is the three things robots do, hot, hazardous, heavy, or something like that—that in a transition from that industrial revolution to this one, that only now are we looking back and suggesting that also one of the things our competitors might have done is they might have taken better care of their work force in the process of building up industry as you defined it to include the entire corporate body of labor and management.

And I think, that again, that is obviously one of the very real concerns of this committee, is to see that that integration and that assimilation of this technology be, in fact, a very real partnership. I don't suggest that people are going to—each of the testimonies this morning, if you read them, has an example of where somebody stoned a harvester or others throughout history.

I think that that is futile in this time. But I also suggest that the chances for serious disenfranchisement of people poses some very, very serious social problems, maybe not this time targeted at a single industry, but rather at a society, and I think that is the kind of challenge, in terms of the merging of industry and Government, that is open to us, at least.

So, thank you very much, and again, I think I can reasonably promise you, maybe not to your delight, that you will be hearing from us again as we proceed down this path.

[Whereupon, at 1:43 p.m., the subcommittee was adjourned.]

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# INDUSTRIAL WORK AND AUTOMATED MANUFACTURING TECHNOLOGY/ROBOTICS: A GROWING SYMBIOSIS

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House Committee on Education and Labor

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INDUSTRIAL WORK AND AUTOMATED MANUFACTURING TECHNOLOGY/ROBOTICS:
A GROWING SYMBIOSIS

I. MAJOR THEMES OF THE EMERGING INDUSTRIAL ENVIRONMENT

A. Manufacturing industries are responsible for a large share of the annual wealth created in the United States. The creation of wealth is essential to the advancement of the standard of living, quality of life, and level of employment.

1. These essential needs may be increased or improved through a reduction in the cost of creating wealth. Thus, reducing the cost of manufacturing is of major importance to the economic and social well-being of the United States.

2. Technological advances provide an extremely significant contribution to manufacturing productivity increases and therefore to reducing the cost of generating wealth.

3. The industrial revolution initiated the large-scale and systematic process of replacing manual labor with machines. Technological advances assist this process by making possible the production of machines of increasing power and manipulative capability.

B. Until the late 1960s, industrial research focused primarily on ways of augmenting human muscle and increasing the mechanical power of production technologies. Since then, the emphasis has shifted to increasing the intelligence of machines without necessarily increasing their mechanical power.

1. Examples of the initial focus include the development of motors, power tools, and farm tractors.

2. The most pervasive example of the newer focus is the use of electronic digital computers in both industrial design and manufacturing processes.

3. Another example just beginning to emerge is the use of microelectronically controlled robots directly on the production line.

C. The key to the burgeoning use of electronic information technology, such as computers and robots, on the factory floor lies in the declining costs and the increasing power and flexibility of microcomputers and microprocessors.

1. Computer intelligence can now be distributed throughout manufacturing operations, either by using computers to control parts of the production process or by building microprocessor controls directly into machine tools and mechanical devices.

2. Instructions programmed into the computer or microprocessor offer both flexibility--ability to manufacture in a wide variety of configurations with minimal effort and cost--and adaptability--ability to adjust or conform to changing environmental conditions and to shift from one task to another.

3. Industry is beginning to learn how to automate the overall production planning effort as well as actually controlling production and handling parts being manufactured; this includes manufacturing the tools, ordering the raw materials, scheduling the production runs, and preparing and modifying product designs.

4. Production is being enhanced by so-called "hierarchial systems". Here, individual machine tools, robots, and work stations are linked to progressively more sophisticated and powerful computers. Essential plant functions, such as material inventory, maintenance, payroll preparation, production processing, and shipping are integated. The system may even supervise non-manufacturing operations.

D. Complex decisionmaking capabilities have been developed and incorporated into mechanical devices which operate without direct human control. These devices are called robots.

1. A significant feature of a robot is its reprogrammability, which means that it is a device or machine tool which tends not to become obsolete when the product it is helping to manufacture does.

2. Robots have the potential to introduce widespread economic and social change and, as always, such change can be perceived from many points of view.

3. As an example, management may consider robotics to be a cost-reducing, productivity-increasing opportunity, while employees and labor unions may regard robots as a threat to job security which may make existing work skills obsolete.

E. In the past, there have not been sustained adverse impacts stemming from automation. However, the development of automated manufacturing technology and robotics could fundamentally affect patterns of production as well as the world trade and international investment positions of the United States.

1. Contrary to popular belief, a majority of U.S. industrial products are not mass produced in long production runs; rather they are assembled in small batches as styles and sizes change. Automated manufacturing and robotics are capable of taking over many of the short- and medium-batch production runs.

2. Automated manufacturing and robotics may allow job shop and smaller vendors that supply needed components and assemblies to compete with the giant high technology firms that are entering the industry.

3. The United States currently retains a lead internationally with respect to productivity, but its growth has been slower than some other industrialized nations--nobably Japan. These nations are turning to automated manufacturing and robotics in a large way and could pose a serious threat to the Nation's international competitiveness.

F. Some of the workers who may be displaced as a result of automation may be retrained or transferred to other jobs within the manufacturing organization, and some will be scheduled for early retirement.

1. However, some employees in the manufacturing sector may be laid off due to job eliminations and decreased manpower requirements.

2. The extent and nature of the transition will depend on a variety of factors including:

(a) Ages of the workers;
(b) Amount of and transferability of the knowledge and skills possessed by the workers;
(c) Ability of the economy to reabsorb laid-off employees;
(d) Rates at which automation technology and robots are introduced; and
(e) Policy mechanisms established to guide the transition by both the private and public sectors of the economy.

## II. MAJOR DEFINITIONS AND CHARACTERISTICS OF AUTOMATED MANUFACTURING TECHNOLOGY AND ROBOTICS

### A. Essential definitions

1. "Automated manufacturing" relates to the use of the computer in the manufacturing process. The computer could be used to assist in the

creation or modification of a design of a product or device, in the operation and management control of manufacturing, and to provide automatic control or machine tools.

2. A "robot" can be considered a mechanical device which can be programmed to perform some task of manipulation or locomotion under automatic control. An intelligent robot is one which can be programmed to make performance choices contingent upon sensory inputs. Robotics concerns the discipline which develops and applies robots in manufacturing and in other areas, such as space exploration and subterranean and undersea mining.

3. "Programmable" means a device capable of being instructed to operate in a specified manner, such as grasping and moving an object.

4. "Manufacturing systems" relate to the arrangement of machines--including robots--and their interconnection by some transport system which carries work to the machines. A factory usually contains one or more such systems as well as storage buffers and the communications networks to interconnect them.

5. "Computer aided design and computer aided manufacturing (CAD/CAM)" are basically automated drafting systems to which vendors are gradually adding design analysis and manufacturing capabilities, such as machine tool and robot control, and process planning.

B. Components and characteristics

1. A robot has five major components:

   (a) Sensors to provide input data from known environments;
   (b) Effectors to perform physical operations for the modification of the environments;
   (c) Microcomputers to implement and control the sensors and effectors to reach established goals;
   (d) Telecommunications networks which sends signals to and from microcomputers; and
   (e) Energy sources which consist of power components.

2. A diversity of skills and knowledge is needed to work in an automated manufacturing environment, including:

   (a) Mechanical engineering;
   (b) Electronic and computer engineering;
   (c) Electrical and mechanical maintenance;
   (d) Computer programming;
   (e) Industrial and production engineering; and
   (f) Marketing.

3. Successful robots must be able to carry out a series of actions and simulate and test the execution of these actions within a model of the environment that is constructed for them. They must analyze

continually the correspondence of their actions to a changing environment. They do this by acquiring and analyzing sensory information and carrying out needed corrective actions.

4. Sophisticated robots can move in many directions, calculate the quickest path for performing assigned tasks, and automatically adapt their performance when different versions of a part comes down the production line.

## III. POTENTIAL AND ACTUAL APPLICATIONS OF AUTOMATED MANUFACTURING AND ROBOTICS

A. The flexibility, positioning, repeatability, lift-handling capacity, dexterity, and speed of present-day robots enable them to perform an ever-widening variety of industrial operations, including what can be loosely described as handling applications, processing applications, and assembly applications.

1. Handling applications, where the robot arm is equipped with a gripper, vacuum cup, or some other kind of "hand", consist of jobs such as loading and unloading metal-cutting machine tools, presses, injection molding machines, and die casting machines; moving materials or parts from one station to another; retrieving parts from storage areas or conveyors; packaging and palletizing items.

2. Processing operations encompass any operation in which a robot manipulates a tool to carry out a manufacturing process. Spot welding is a pervasive example of this type of application; arc welding, spray painting, dimensional checking, drilling and venting molds are other examples.

3. Assembly operations, consisting of picking up parts from various locations and orientations, possibly some part inspection tasks, and verifying the completion of assembly operations, rely greatly upon a robot's visual and/or tactile capability.

B. Traditionally, the automobile industry has accounted for close to half of the robots used; this industry is followed closely by die-casting firms. However, the appliance, electronics, aerospace, metals, farm equipment, instruments, mining, space, and undersea exploration industries are steadily increasing their use of robots.

C. Versatile robots could lead to deeper, narrower, more extensive subterranean exploration and could open new resources for economic development. This is particularly true of coal mining where it could become economically possible to trace coal veins through unconventional paths without a requirement for humans to operate in the shafts. The same concepts could apply to undersea mining.

D. Robotic technology could have a dramatic effect on the character of space exploration and application by drastically changing the balance of costs and reliability. Robots could operate onboard systems, make remote maintenance possible, repair spacecraft systems and make power, size, weight, endurance, structural strength, process speeds, reliability, maintenance, and hazard control less rigidly constrained than if human astronauts were present.

E. In medicine, application possibilities include radiation therapy, fully automated patient monitoring in intensive care, and micro-surgical implants.

F. An interesting application is the "window-cleaning" robot that is used for automatic cleaning operations in high buildings. Maintenance costs are reduced, dangerous work eliminated, and privacy is protected.

G. Robots are usually better than humans for work that is repetitive, hazardous, unpleasant, highly precise, calls for great physical prowess, and requires remote control.

H. As the technical capabilities of robots improve and as knowledge of how to utilize robots grow, they could be used more extensively in areas where they have proved effective as well as in many new areas. As robots are given sensory and decisionmaking capabilities, they will be able to work in unstructured and variable environments.

I. Computer aided design (CAD) and computer aided manufacturing (CAM) applications encompass sketching alternative designs quickly, annotating these sketches, producing drawings in various "orthographic" projections, subjecting parts to stimulated vibration and stress tests, and furnishing computer programs for control of machine tools required to machine parts. Another evolving capability, is the ability to program robots as well as machine tools. Such integrated systems will increase application possibilities.

## IV. DRIVING FORCES ENCOURAGING DEVELOPMENT AND EMPLOYMENT OF AUTOMATED MANUFACTURING TECHNOLOGY AND ROBOTS

A. Productivity and cost-oriented forces.

1. The use of robots and automated manufacturing technology can contribute to increased productivity. Although robots generally work at a slower rate than humans, they operate at a consistent pace and can work multiple shifts continuously.

2. From 1947 to 1965, the U.S. productivity growth rate increased by 2.4 percent a year; it dipped to an average of 2.3 percent in the subsequent ten years; it dropped below one percent in the late 1970s. Japan's productivity growth rate by contrast has been climbing at an annual

rate of about 7.3 percent over the last 10 years. 1/ Robots and automated manufacturing show promise for improving the Nation's productivity and reducing its productivity gaps vis-a-vis other nations.

3. Robots can be reprogrammed quickly and inexpensively to shift from one production task to another. Consequently, automation is no longer restricted to factories that mass produce identical products. It is now economically feasible to automate production processes that involve short production runs and frequent changes in machine settings. A majority of manufacturing processes fall into this category.

4. U.S. labor costs have been continually increasing over the last decade and are expected to continue to do so over the present decade. Thanks largely to greatly reduced microprocessor prices, robot costs also have declined and should not increase too much over the next decade even with the introduction of sophisticated robots with sensory and intelligence capabilities.

5. Because automated manufacturing techniques permit manufacturing parts to very fine tolerances, parts and material wastes tend to be minimized and product quality improved.

6. In some cases, the application of automated manufacturing and robotic techniques can make considerable energy savings possible. For instance, robots do not require heat, light, or air conditioning to operate.

7. Computer aided design and computer aided manufacturing techniques provide greater degrees of freedom in design, better manufacturing control, shorter lead times, greater operating flexibility, and improved product reliability.

B. Forces related to the quality of work life

1. Robots have the potential to improve the working environment with respect to its safety and health features. In many computer-controlled environments, there is less exposure to harmful substances and less possibility of employee injury. This could make it easier for manufacturing firms to comply with Federal (including OSHA) regulations.

2. Robots can be used in dangerous, unhealthy, and repetitive jobs and can perform monotonous and environmentally harmful tasks. Employees thus can, theoretically at least, move to more intellectually challenging and less physically demanding jobs. These jobs could include maintenance and repair of robots, programming them, and providing instruction in monitoring and using robots.

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1/ United States-Japan Trade Council. Robotics in the United States and Japan. Council Report No. 46. Dec. 12, 1980. p. 3.

C. Forces related to technology

1. The ability to develop automated manufacturing and robotic devices has been brought about by progress in, and concurrence of, several technologies including:

   (a) Artificial intelligence;

   (b) Intelligent sensor and effector design;

   (c) Microprocessor and computer design;

   (d) Distributed processing network design;

   (e) Software development; and

   (f) Data Management system development.

2. Hierarchical control is an important concept in automated manufacturing. The implementation of such control calls for elements at higher levels having priority over elements at lower levels. Two examples are prominant:

   (a) Control hierarchy whereby the results of higher level control elements are used to command lower level elements; and

   (b) Sensor hierarchy whereby the results of lower level elements are utilized as inputs by higher level elements.

D. Forces related to markets

1. While robots are flexible devices, they still are likely to be custom-made for a specific user according to his specific production process. Consequently, the robot-maker, even if a small firm, can specialize in a specific type of process and successfully compete with big corporations.

2. Automated manufacturing and robotics offer opportunities to manufacturing industries which face the threat of losing their markets to foreign producers, especially Japan, which are upgrading their facilities with computer-controlled technology.

3. A number of high technology, diversified, giant organizations, like IBM Corporation and General Electric Corporation, have entered the currently small robotic industry. Their entry is likely to greatly expand the robot market and create an explosion in sales.

V. LIMITING FACTORS INHIBITING DEVELOPMENT AND EMPLOYMENT OF AUTOMATED TECHNOLOGY AND ROBOTS

A. People-oriented factors

1. While robots are flexible and automated manufacturing is efficient, it takes considerable time to adapt them to current factory operations. The operations may have to be modified, the surrounding environment changed, programming performed, and testing carried out. Perhaps even more significantly, production engineers are used to thinking in terms of "hard automation" and special-purpose machines rather than "programmable automation" and general-purpose robots.

2. It will be necessary to gain the acceptance of the "rank-and-file" workers and the unions to which many of them belong. Some jobs may be eliminated and some workers may have to be retrained for the jobs that remain. Not all of these workers possess the ability to learn the skills required to handle the new or other jobs in the organization and not all firms will be willing to bear the costs of retraining workers. In addition, workers may feel that advanced automation is dehumanizing and overcontrolling.

3. Changes in supervisory philosophies and methods and in organizational structures will be necessary in many cases. Supervisors will require time to learn how to supervise under radically changed conditions, relationships, and production operations. Unlearning old habits and ways of doing things may be difficult.

4. There is currently a severe shortage of qualified persons who can market, design, implement, manage and maintain automated manufacturing technology and robots. Consequently, there is also a dearth of qualified instructors to train supervisors, engineers, technical personnel, and direct labor in the needed skills and knowledge.

B. Cost-oriented factors

1. Initial investments to purchase and incorporate robots and associated automation technology into production lines can be quite high and, for some small firms, prohibitive. Retrofitting may be limited by available space and by limitations in existing production facilities, processes, and operations. In some cases, new plants may have to be constructed. There also will be the usual depreciation and interest costs. However, there may be no markets for divesting existing equipment which may not have been fully depreciated.

2. The degree of willingness of manufacturing firms to accept the costs of transition also depends on such economic factors as future interest and wage rates. If these rates remain high, adoption of automated manufacturing and robotic technology by manufacturing firms may be slower than anticipated.

C. Technical factors

1. There are still a number of technical problems to overcome for automated technology to be sufficiently effective and efficient in some industries. Some of these are:

   (a) Robot manipulators cannot yet duplicate the dexterity of the human hand;

   (b) Robots still are severely limited in their ability to "see" and to "feel" the positions of objects and carry out necessary measurements;

   (c) Robot control systems are unable to take full advantage of sensory data available from current sensors to modify the robot's behavior as the environment changes;

   (d) Techniques for developing robot software are still inadequate, especially with respect to programming languages and debugging tools;

   (e) Interfaces are not defined in a standardized manner so that robots, machine tools, sensors, and control computers can be connected together to form integrated systems and perform synchronized operations; and

   (f) Robot structures are still quite massive and unwieldly and are able to lift only about one-tenth of their weight.

VI. POTENTIAL IMPACTS OF AUTOMATED MANUFACTURING AND ROBOTIC TECHNOLOGY

A. As the introduction of automated technology in manufacturing accelerates, so will their impacts--both direct and indirect.

B. As the United States proceeds towards the development of robots, computer-aided design and manufacturing, and totally automated factories, severe strains could be placed upon its economy--currently rather static. Large-scale dislocations could occur, such as the phasing out or the downgrading of many types of skilled, semi-skilled, and unskilled jobs in certain geographic areas, shifts in the division of labor, new skills and knowledge requirements for new and modified jobs, revised working times, different relations between work and income, redistributions of wealth, and increased numbers of retirements. Such dislocations would complicate the solution of the Nation's seemingly persistent economic growth and problems of social and business equity.

C. On the other hand, robots and automated manufacturing technology could significantly contribute towards the reindustrialization of the United States. This would be manifested by the emergence of new occupations, technologies, and even industries; reduced inflation resulting from lower product prices

caused by improved production methods; expanded markets for manufactured products caused by lower prices, higher quality, higher reliability, and greater diversity of products; and improved utilization of scarce resources such as materials, energy, and capital.

D. A forceful demand by workers and unions for retraining and new training in the use and maintenance of the emerging automation technologies would inevitably arise. Executives and virtually all of manufacturing management would have to be instructed in the nature of automation, including robotics. Finally, the sophistication of the automated equipment would call for a high level of competence from design engineers and application planners.

E. There is likely to be further questioning of the "work ethic" by "blue-collar" members of society. The idea that it is morally reprehensible not to be working hard all the time easily could become less ingrained in U.S. culture. This, in turn, could lead to greater value being placed upon leisure and education time and to an exploration of the rights of labor for continuing compensation during those times.

F. Sophisticated automation in the manufacturing sector of the U.S. economy will contribute, along with the office, transportation, communications, services, and education sectors, to a growing awareness of computers and telecommunications and the need to become "computer literate." Reading, writing, and computing may replace the old "hallmark" of literacy.

G. Unusual legal problems can be expected to rise, particularly since new questions undoubtedly will be asked with respect to the extent of liability for suppliers of robots and for producers using robots to manufacture products. In addition, the possibility of liability suggests the need for some sort of insurance to protect manufacturers, sellers, and users of products of robotic technology.

H. The international competitiveness of the United States would benefit if the prices of U.S. goods sold abroad are reduced relative to the Nation's trading partners and new and expanded overseas markets arise. Such price reductions also are dependent upon U.S. monetary and fiscal policies, tariff and quota barriers, exchange rates, transportation costs, and differences in tastes and incomes.

## VII. PROBABLE ADVANCEMENTS IN AUTOMATED MANUFACTURING TECHNOLOGY AND ROBOTICS DURING THIS DECADE

### A. Technology focus

1. Sensing devices—especially those for visual and tactile sensing—will be installed in robots to enable them to adjust automatically to dynamic production set-ups. They will be capable of detecting, recognizing, reorienting, and then manipulating disordered parts and performing complex

assembly operations utilizing acoustic, optical, electromagnetic, and other techniques.

2. Advancements in "artificial intelligence" will enable robots to have specific parameters reflecting judgmental values built into their computer programs. When a robot comes upon a situation for which it is not specifically programmed, it will be able to make logical decisions based on what it "knows", act accordingly, modify the act if necessary, and then put both the situation and the new decision into its memory.

3. Previously independent machine tools, robots, transfer mechanisms, and parts-handling devices will be linked together and integrated into the manufacturing process as a total system under a "hierarchical control structure." This would bring the automated factory closer to reality. Such a system would have the capability to perform interactive graphics to design parts and products, do process planning to specify needed operations and their order, production planning and scheduling to schedule machines and route parts, control machine tools to cut and form parts, and to use robots for acquiring, transferring, inserting, assembling, testing, welding, and painting parts and products.

4. High technology robots have been dominated mainly by heavy duty machines with size and reach or "work envelopes" of up to 1,000 cubic feet and load capabity or "payloads" of over 350 pounds. Smaller and less expensive robots will be developed and utilized for industrial tasks requiring reduced envelopes and payloads.

5. The coming generation of robots also should have such technological improvements as:

   (a) Greater mobility;

   (b) Recognition of voice commands;

   (c) Versatile general-purpose manipulators.

B. Cost and productivity focus

1. If the cost of manufacturing electronic devices continues to drop, due primarily to continued semiconductor advancements, and if software developments of "friendly" easy-to-learn-and-use software, the price of robots, even sophisticated ones, should decline.

2. Expansion of the robotics should be greatly accelerated if a dozen or so major electronic manufacturers--each possessing considerable distributive strength, well-cultivated reputations, and abundant resources--enter the field as expected. This will bring about economies of scale, raise robot production volume, increase robot sales, and keep costs at reasonable levels.

3. For those manufacturing tasks where the cost of robot labor falls below that of human labor or where the capabilities of robots are superior to

those of human labor, manufacturing productivity is expected to progress as fast as resources are committed to improving robotic technology.

C. Applications focus

1. Gradually, as robots become more mobile, they can be expected to make inroads into the construction trades. They will move around dirty and muddy construction sites; lift, carry, and position heavy construction objects and materials; and dig and scoop the earth.

2. Robots should be able to perform most of the dangerous operations inside nuclear power plants. This would considerably reduce threats of sabotage theft of nuclear materials as areas where the automated operations are performed could be sealed and safety and health hazards to the remaining workers would be minimized. If nuclear accidents or malfunctions occurred, robots could be employed in the radioactive areas to perform repair and and clean-up operations.

3. Robots also are well suited for underwater applications. They could operate at any depth and provide effective working capacity in a compact package. They could explore for minerals, operate underwater drilling equipment, and perform underwater construction.

4. Houshold robots should begin to emerge to perform some simple household chores, such as lifting, cleaning, dusting, washing, and polishing. Internal maps of the rooms in a house and their relative positions can be provided by computer software; they would contain the nature, characteristics, and positions of objects in each room.

## VIII. MAJOR ISSUES FACING PUBLIC AND PRIVATE POLICYMAKERS

A. Attrition in the workforce means that workers leave their jobs--either because they are separated, retire, resign, become disabled, or die. The total of such worker separations from jobs constitutes the "national attrition." If new jobs are not created at a rate close to the rate of national attrition, the United States will not maintain the distribution of purchasing power required for a healthy, viable national economy. If a disproportionate number of job displacements takes place in particular geographic areas which already have shrinking economic bases and where manufacturing employment constitutes a high percent of total employment, the goal of keeping the two aforementioned rates close will become more difficult. What are the respective roles of the public sector and the private sector in keeping the rates of job attrition and job creation close together?

B. Retraining and new training in various skills and knowledge will have to be given to "rank-and-file" employees, supervisors, executives, and technical personnel to ensure that the emerging automated manufacturing and robotic technologies are configured, installed, employed, and maintained in the manner desired. How much, if any, retraining and relocation

assistance should be the responsibility of individual manufacturing firms and should government—Federal, State, and/or local—provide any funds, facilities, instructors, or other forms of subsidy for retraining or relocation?

C. For most of the past two decades, the United States has been faced with high labor costs, little, if any, growth in productivity, and high energy costs. Advanced automated technology and robotics is expected to provide some direct improvements to these tough, persistent national problems in the near term. The indirect, longer-term impacts of these technologies, however, may not be as beneficial as anticipated. A complex of intervening factors and causes gradually may generate significant and permanent social changes in cultural life styles, in group attitudes, and in personal values, and there may be substantial and permanent economic changes in international trade, capital investment polices, organizational structures, and basic research in automation and robotics.

Change due to the introduction of technology is inevitable, but concomittant hardships need not be inevitable. How should automated manufacturing technology be introduced so as to minimize the hardships it may engender? How should the Federal Government exercise its traditional roles of regulation and its enforcement, and the promotion of free enterprise in order to help minimize potential hardships?

D. Workers, and the unions they belong to, often are suspicious of technological change. Most employees want to be assured that such change will not dehumanize their working conditions, reduce their earnings, make their jobs redundant, and exert excessive surveillance and control over their work behavior. Management officials in manufacturing industries claim that technological progress is essential if their businesses are to grow, prosper, and even survive. They declare that they critically need the labor-saving, productivity-improving, materials-conserving, quality-raising changes that advanced automation can bring. How can the social and personal costs that often accompany automation efforts be properly balanced against the pragmatic economic conerns of manufacturing firms?

E. The very essence of sophisticated manufacturing technology and robots—their adaptability and their intelligence—could give rise to unique problems in patent and copyright law. The concepts of "artificial intelligence"—the ability of a device to perform functions that are normally associated with human intelligence, such as reasoning, problem-solving, pattern recognition, cognition, planning, understanding, and learning—may not fit the historical types of computer software which may be copyrighted. Robots will be controlled by software which can continually modify their actions in accordance with environmental conditions. Software also can be embedded in hard form as silicon chips which can fit into a patentable apparatus class. Software encompassing the concepts of artificial intelligence may not be patentable. Should some form of special patent for robots or copyright or robotic programs be derived?

## IX. OPTIONS FOR RESOLVING THE MAJOR ISSUES

### A. Alternative private sector initiatives

1. Since, to some degree, over the next few years, jobs in manufacturing industries will be performed by robots, it is important to identify alternative initiatives that might ease the adjustment of workers displaced.

2. Private sector initiatives could include a mixture of the following options:

   (a) Reduce labor force by natural attrition, rather than layoffs, as much as possible;

   (b) Provide for early employee retirement when feasible;

   (c) Reduce weekly work hours with no proportionate reduction in income;

   (d) Furlough employees on a rotating basis;

   (e) Provide ample notice of anticipated workforce reductions;

   (f) Transfer excess workers to other current jobs;

   (g) Develop new jobs, such as performing long neglected but useful tasks;

   (h) Institute a job-sharing, part-time work program;

   (i) Provide opportunities for employees to learn new skills, such as paid educational leave or attendance at company-sponsored educational programs;

   (j) Provide as much severance pay as possible;

   (k) Provide moving allowances for workers who have to transfer; and

   (l) Utilize the collective-bargaining vehicle to reach agreements.

### B. Alternative public sector initiatives

1. The potential and complex problems of advanced automation may require solutions that transcend normal bargaining agreements between unions and managements. Responsibilities may have to be shared by all key members of society--business, labor, special interest groups, governments, and the general public.

2. Public sector initiatives could include a mixture of the following options;

   (a) Establish national goals and priorities for advanced automation in the manufacturing sector;

   (b) Ensure the benefits of automation are shared by all societal members;

   (c) Monitor the workplace and identify adverse impacts of the applications of advanced automation;

   (d) Provide public assistance to retrain displaced workers;

   (e) Provide adequate unemployment insurance;

   (f) Provide improved depreciation rates on advanced automation equipment;

   (g) Provide low-interest loans to manufacturers and purchasers of automation equipment and robots--especially small firms;

   (h) Sponsor more research and development efforts in automation by universities, manufacturing firms, and other qualified organizations, including studies of social and economic impacts of automation;

   (i) Provide tax incentives to encourage increased investment in robot and automated manufacturing technology;

   (j) Promulgate long-range and technology forecasting studies to identify long-range and indirect impacts of advance automation;

   (k) Modify patent laws and copyright laws to permit individual entrepreneurs to retain adequate proceeds from their inventive efforts in advanced automation; and

   (l) Provide incentives for large firms manufacturing advanced automation equipment to nurture small new enterprises which could provide employment to displaced workers.

3. Ultimately, the Nation's educational system will have to prepare future workers for functioning in an electronic manufacturing environment. For the near term, the Federal Government could utilize existing educational organizations established by legislation. For example, it could restructure the Advisory Council on Vocational Education, established under the Vocational Education Amendment, to focus vocational education policy in a direction that would give students the necessary skills for a technological environment. The Federal Government also could provide increased funding to private industry councils which have the goal of determining the types of training efforts that best meet the needs of both the private sector managements and potential employees.

4. Another option that could be considered is to establish a semi-private investment corporation to finance manufacturing companies. The corporation could purchase stock from private industry to aid manufacturing firms purchase and utilize advanced manufacturing automation. The dividends and interest received could be used for public purposes such as providing assistance to displaced workers.

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# SUMMARY AND ANALYSIS OF HEARING: THE SECOND INDUSTRIAL REVOLUTION: NEW TECHNOLOGY IN THE AMERICAN WORKPLACE

Prepared for the House Committee on Education and Labor
Subcommittee on Labor Standards

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## I. INTRODUCTION

Advances in computer and microelectronic technologies have led the American society into the initial stages of what some persons consider a second industrial revolution and others consider a knowledge revolution. Regardless of the labels assigned to the emerging developments in the aforementioned technologies, these technologies are having a significant impact on two major sectors of our society, namely the office and the factory. To gain information on these developments and analyze the consequences, the Subcommittee on Labor Standards of the House Committee on Education and Labor held a hearing on June 23, 1982, on the topic of "New Technology in the American Workplace."

The Honorable George Miller, Chairman of the Subcommittee on Labor Standards of the House Committee on Education and Labor, stated at the outset of the hearings that the subcommittee's interest in this subject has grown out of its desire to ensure that the United States is able to improve its productivity in both office and factory environments in order to meet effectively the increasing competition from foreign nations and that any increases in productivity stemming from technology be accomplished with a minimum of permanent adverse impacts on office and factory employment.

The subcommittee organized three panels of expert witnesses, with each panel covering various aspects of the broad subject area. The witnesses comprising each panel and the major perspectives of the panels were:

Panel No. 1

Mr. Brian L. Usilaner, Associate Director, National Productivity Group, General Accounting Office; and

Mr. Dennis Chamot, Assistant Director, Department for Professional Employees, AFL-CIO.

The testimony of this panel focused primarily on the overall aspects of automation in the American workplace.

Panel No. 2

Ms. Amy Wohl, President, Advanced Office Concepts;

Mr. Stan Schrager, Vice President, Chase Manhattan Bank; and

Ms. Judith Gregory, Research Director, 9 to 5, the National Association of Working Women;

The witnesses comprising this panel concentrated their discussion on the emerging uses and likely impacts of information technology in the office environment and on the total society.

Panel No. 3

Mr. Dennis Wisnowky, Vice-President, GCA Industrial Systems Group;

Mr. George Munson, Vice-President, Unimation, Inc.; and

Mr. William Bittle, Economist, Research Department, International Association of Machinists and Aerospace Workers.

The witnesses in this panel centered their discussion around the emerging employment of advanced manufacturing technology, including robots, in the factory environment and their likely impacts on the total economy.

This report identifies, summarizes, and analyzes the major themes discussed by the witnesses in each of the aforementioned panels.

## II. BACKGROUND

Dramatic advances in computer-based information processing and telecommunications-based information transmission, as well as their convergence in practical applications, appear to be creating an environment which is being referred to as the "information age." Much has been written about the promise of this evolving age by both social scientists and physical scientists. Many of these experts see a new global awareness and interdependence that is being rapidly stimulated by telecommunications and satellite technology. They cite the possibility for expanding human intelligence by the use of problem-solving software, large well-organized data bases, and hardware processing sophisticated data manipulation and display capabilities.

These experts, along with a number of other experts in information technology, also predict the emergence of new business and home computer-communications systems that will be able to provide wider choices to managers and more prerogatives to consumers concerning information per se and for products and services generated by information technology. In addition, these new systems will be capable of providing very rapid feedback on the results of managerial decisions and consumer preferences. It is expected that the evolving systems for businesses and homes may have a potential for large savings of time, effort, and money for producers and distributors through significant increases in office and factory productivity.

The explosive growth of information handling technology has also highlighted the viability of information per se. Private information is collected to perform functions and public information is used to develop private information services. Census information is a well known example of these processes. The United States society is becoming more dependent upon information and associated services as well as on the technology for its transmission, storage, and manipulation. Federal and private sector policies which address what information products and services are to be provided, who should provide them, and under what costs and other constraints, go to the core of the Nation's socioeconomic structure and activity. The stakes, the markets, and the investments in computer and communications technology and the information such technology can generate are growing at a significant rate. At the same time, the related vested interests, although quite diverse, are becoming more powerful.

Sophisticated computers and telecommunications networks are being developed and applied at ever increasing rates to the office and factory environments. The number of products and services aimed at these markets is expected to proliferate over the decade of the 1980s. The traditional office--a physical place where managers, professionals, and associated support personnel work, individually and interactively, to produce various types of paper-based outputs--is changing. It is becoming a dispersed system which utilizes computers and computer-based devices to capture, store, manipulate, and disseminate information and telecommunications networks to transmit data, voice, images, and text among several locations. In the factory workplace, computers are being used to control many parts of the production process; also, microprocessor controls are being built directly into machine tools, robots, and other devices

used for manufacturing. These microprocessors can be reprogrammed when needed to perform brand-new tasks and functions. Computer-Aided Design (CAD) is being applied to create two- and three-dimensional images for all sorts of products and parts. Gradually, a "multi-tier" form of computerized control will create extremely flexible manufacturing systems capable of producing, transporting, and controlling several thousand pieces of work simultaneously and automatically adjusting their operations in response to changing needs.

In the past, there have not been sustained adverse employment impacts stemming from automation in the office and factory workplaces. However, some experts believe that this may not continue to be true as the microprocessor-based computers and networks enter these environments in great numbers. They contend that the machines, the services, and the software associated with information technology today and in the future will possess much of the flexibility and decisionmaking ability that was formerly only obtainable from human workers. Consequently, many jobs that required human beings to perform may become obsolete. Further, they maintain that while many new jobs will be created as a result of the application of information technology, a high majority of them are likely to be in high technology fields which require considerable education. Thus, some experts anticipate that the formation of new jobs for blue-collar and white-collar persons with limited education may be severely limited in the future. Of course, there are also those who assert that the new jobs and the new industries that will develop from the emerging information technology will be able to absorb all types of persons seeking work--regardless of education level.

## III. MAJOR THEMES CONCERNING AUTOMATION TECHNOLOGY IN THE AMERICAN WORKPLACE

The first two witnesses, Brian L. Usilaner and Dennis Chamot, discussed automation in the American workplace in an all-inclusive manner. Their testimony centered around three major themes, namely: (1) Role of the Federal Government in Automation; (2) Stimulators and Barriers to Rapid Automation; and (3) Potential Impacts of Automation on the Work Force.

### A. ROLE OF THE FEDERAL GOVERNMENT IN AUTOMATION

Both of the aforementioned witnesses agreed that the Federal Government should assume a role in the development and implementation of automation technology. Mr. Usilaner declared that the private sector should assume primary responsibility in this area with the Federal Government developing policies and programs to encourage continued growth in automation and addressing employment and unemployment problems that automation may create. He suggested that the Federal Government should get involved in five ways:

1. Provide financial incentives, such as more rapid depreciation of plant and equipment and increases in investment tax credits to stimulte capital investments by private firms wishing to automate;
2. Provide greater support for research and development (R and D) related to automation both within and outside the Federal Government in a manner which facilitates a more comprehensive and integrative R and D strategy;

3. Exert greater efforts to transfer the results from R and D into commercial use and to coordinate such transfers more efficiently;
4. Provide more funds to improve the state of engineering schools so that they could admit and train more automation engineers; and
5. Provide encouragement to the development of standards which will help to integrate the diverse components of diverse automation systems.

The other major category where the Government might be involved in the automation of private industry is in the potential impact of automation on the work force, stated Mr. Usilaner. He commented that "this area is characterized by controversy over the appropriate roles in addressing labor displacement, skills training and retraining, and potential friction between labor and management."

Both witnesses compared the role of the U.S. Government in automation to that of other nations and both witnesses perceived that we are lagging behind in formulating policy sufficient to meet the challenges presented by the accelerating developments in information technology. Mr. Usilaner called attention to our declining national productivity and said that we are lagging behind other industrial nations in implementing automation. He noted that growth in the capital/labor ratio is an important key to productivity and added that the Japanese, who are making extensive use of our automated manufacturing technology, have maintained a much higher relative capital/labor ratio than the United States between the years 1973 to 1980. Mr. Chamot gave a somewhat different reason for our policy lag. He stressed the view that the American approach to automation seems to place a great deal of faith in technology itself. He stated that our policymakers seem to believe that if we develop more sophisticated automation systems productivity will automatically rise

and our productivity problems will tend to evaporate. He said, "our European brethren have been much less willing to simply let things drift. Their governments have been far more willing to help not only business, but also affected workers and communities." He seemed to imply that the Federal Government should take a more active and direct role in advancing automation by focusing on social cost and human impacts of automation and upon increasing the degree of cooperation among the business community, labor unions, and the Government in planning and implementing programs in automation technology.

Mr. Chamot provided quite a number of illustrations to justify his position. He noted that the Swedes have developed extensive Government-funded training programs for the structurally unemployed and have established commissions, incorporating members of both labor and management, to study social problems that could arise from technological change and to make recommendations for action. The state and local governments in Germany also work cooperatively with industrial unions and employees, he remarked. They jointly develop programs which include not only tax incentives to attract new businesses into affected communities but also retraining programs for people directly affected. The German Government funds studies not only to promote new technologies but also to promote the humanization of the workplace. Finally, he commented that the British also have funded studies on the manpower implications of the emerging sophisticated technology and also have provided financial support and technical advice for worker training and retraining programs.

B. STIMULATORS AND BARRIERS TO RAPID AUTOMATION

There was little disagreement between the two initial witnesses that several diverse and significant barriers and a number of important and

different stimulators to automation were present in the American economy. Automation barriers tend to impede the rate of adoption of information technology while automation stimulators tend to motivate both producers to perform research and manufacture information technology and users to buy the products and services stemming from this technology.

Mr. Usilaner addressed the topic of barriers to rapid implementation quite comprehensively and categorized them as technical, financial, and social in nature. The five technical barriers he delineated were:

1. A lack of technical expertise to design, debug, and implement automated technologies;
2. Problems and costs in developing the software to make the systems work;
3. An absence of the necessary standardization;
4. A shortage of qualified persons to operate and service automated equipment and systems; and
5. Technology transfer inefficiencies and problems.

He pointed out that the personnel shortage was especially critical, including the dearth of software developers and manufacturing engineers.

The financial barriers he stated were:

1. The current high interest rate;
2. The tendency of business to focus on short-run needs;
3. Other capital investment considerations such as cash flow, cost recovery, and the risk involved in investing in new, untried equipment; and
4. The uncertainty of the marketplace.

He continued by saying that the social barriers can be "subtle and obvious," manifested by managers and their styles, organizations and their structures, consumers and their habits, and unions--who may be quite apprehensive about what they consider to be the negative effects of automation technology in the workplace.

Mr. Usilaner seemed to suggest that while some of the barriers are being overcome, others may persist for several years, despite the presence of powerful

stimulators. The witness also emphasized that rising labor costs, decreasing competitiveness in the world market, and shrinking market shares, while problems in our economy, also act as stimulators to the development and use of automation technology. Potential users seek such automation to reduce costs, increase market share, and meet competition more effectively. In addition, he noted that the large market potential for information technology also acts as a strong stimulator to manufacturers "to create new and better products, systems, and support services."

While not using the words "barriers" and "stimulators" per se, Mr. Chamot's testimony did imply that the potential for automation to eliminate human activities, reduce skill requirements for some crafts, and decrease the quality of working life could constitute significant constraints upon rapid adoption of automation technology--especially by unions.

On the other hand, he mentioned that "further development in computer vision and tactile sensing may act to automate a good deal of assembly work and materials handling activities in manufacturing firms." He admitted that continuing capitalization and reorganization of office work would likely improve decisionmaking and work flexibility in service areas of our economy. He thus implied that investments for information technology in office and service areas could be considered stimulators to automation--at least to the extent that they led to new products, new services, and new jobs.

In general, both witnesses appeared to accept the idea that automation will likely expand over the next few years. The nature and tone of their testimony revealed that rapid growth in automation depended on how effective the stimulators were in overcoming the fairly explicit barriers. Mr. Chamot placed heavy emphasis on understanding and applying human considerations when automating the workplace, while Mr. Usilaner placed technological and financial

factors more on an equal footing with social (human) ones when discussing the pushes and pulls of automation in the workplace.

C. POTENTIAL IMPACTS OF AUTMATION ON THE WORKFORCE

Both witnesses explicitly recognized the possibility of long-term unemployment that is due to the introduction of information technology (computers and telecommunications) into the American workplace. Further, both indicated a need to balance the demand for new skills created by automation with skills made obsolete, and consequently jobs displaced, by automation.

A large portion of the testimony of Mr. Chamot, who represented the AFL-CIO, was spent on the theme of potential impacts of automation upon the human work force. He thought that "the application of computer and microchip technology, coupled with the range and flexibility of telecommunications systems and other devices and materials, offer a potential for change which is truly profound." He emphasized that the American labor movement was not opposed to technological change or productivity improvements per se; rather, it was concerned with the degree of management and societal awareness of the problems that must be faced and resolved as specific technological changes are introduced into the workplace.

> For example, in manufacturing, new technology which results in the development of new products may well lead to the creation of new jobs. On the other hand, technologies which improve the productivity of processes involved in the manufacture of existing products may lead to a net reduction in jobs, even if output expands. Similarly, in services, replacement of workers by computers and telecommunications systems can reduce employment in the industry, or at least limit growth, even with rising output. In other words, if productivity rises faster than output, employment will drop.

Mr. Chamot referred to the current recession and remarked that "it would be difficult, if not impossible, to get an accurate count of jobs lost to automation in the face of an overwhelming loss of jobs created by poor economic

decisionmaking." Nevertheless, the tone of his remarks appeared to reveal that continued application of information technology in factories and offices will reduce the demand for both blue-collar and white-collar workers in the American workplace over the ensuing years.

In addition, this witness strongly urged that close attention be paid to the human impacts in the workplace as information technology gets implemented there. He optimistically said that the quality of worklife could not only be maintained but improved if such things as increased leisure time for workers, fewer hours in the workday and in the workweek, increased vacations, expansion of the public sector to provide socially useful and needed services, and maintenance of employee control over machines could be incorporated.

"The potential for job displacement is the other side of the coin that must be considered when discussing advancing automation in the United States," stated Mr. Usilaner. He remarked that almost all experts agree that short-term job displacement--a temproary loss of jobs until new jobs are created and filled by retraining workers displaced--will continue for some time. Alternatively, there is little agreement among the experts on long-term job displacement--a relatively permanent increase in unemployment levels. He objectively discussed these concepts further.

> Some believe that unemployment levels will not increase because automation will assist U.S. industries in fighting foreign competition and foster economic growth and create many new jobs. Others think that automation will create structural changes in the workforce because a mismatch between the skills required in the new jobs and the capabilities of those unemployed will occur and the increased capacity to produce goods and services will outstrip the demand. Thus, the economy will not be able to absorb all the displaced workers.

In this connection, Mr. Usilaner made special mention of the limited progress of the U.S. Department of Labor in analyzing the potential impacts of automation, especially in terms of information displacement, job movements, and skill shifts.

## IV. MAJOR THEMES CONCERNING THE OFFICE OF THE FUTURE

The topic for the second part of the hearing concerned the emerging use of computers and telecommunication in the office environment--variously known as the paperless office, the office of the future, the automated office, and the electronic office. The major themes relating to the impacts of information technology in the office workplace were discussed by the three witnesses, Ms. Amy Whol, Mr. Stan Schrager, and Ms. Judith Gregory. The themes revolved around fitting our Nation's human resources into the increasingly technologically-based offices. Specifically these were:

1. Changing Working Conditions in the Office;
2. Computer Literacy and Training in Office Automation; and
3. Job Displacement Potential in the Office.

### A. CHANGING WORKING CONDITIONS IN THE OFFICE

While all the witnesses agreed that our Nation will see an enormous influx of information technology, both hardware and software, into business and professional offices they did not agree on the ways such technology is likely to impact working conditions in the office. One witness felt that the office generally will benefit; a second was much less convinced of the benefits of office automation--at least as it is now progressing; and a third witness appeared to be uncommitted to a definite position in either direction.

Ms. Wohl declared that office automation is unlikely to evolve in an orderly, gradual way. She thus implied that there would indeed be a "revolution in office

work." She stated that "jobs of office personnel will change significantly in the next few years and that these persons will be interacting with various types of computer-based systems most of the time." This witness did not think that these developments would dehumanize the office workplace or allow computers to control office workers; rather, "they [computers] will do what they are told." She stressed the fact that since personal computers and associated products were being ordered, installed, and used in offices at very rapid rates, the way people will work in these offices will inevitably change. She implied that these changes are likely to be primarily positive.

The testimony of Ms. Judith Gregory had a much less optimistic tone. She declared that "office workers will find themselves threatened with many of the same processes of job degradation which undermined the skills and dignity of an earlier generation of industrial workers." She believed that information technology would only add to the existing problems of clerical workers--most of whom are women--namely, that of low pay, job segregation, dead-end jobs, and discriminatory employment practices. She believes that the majority of women office workers will have to become more specialized and perform smaller fractions of the larger tasks; consequently, they will require less training and have less chance for advancement. In addition, she noted, as clerical workers use comptuer-related technology, job stress is likely to increase and occupational health hazards are likely to become significant. She gave as examples of this possibility the fact that computerized monitoring of workers' speed and volume is beginning to take palce, and eye and muscle strains caused by working intensively with video-display terminals is increasing.

On the other hand, this witness was careful to point out that "it's not the technology per se which cuases these problems, but rather how the technology is used by management, and how workers are allowed to, or forced to, use it."

She saw no reason why working conditions in the office could not be improved if conscientious attempts were made to do so by management.

> Flexibility and versatility of computer technolgy make these possibilities uniquely possible: to make better jobs, better working conditions, better use of human resources, unprecedented chances for advancement, address and reduce discrimination, ability for improved services and more available services.

Mr. Schrager, the last witness in this part of the hearing, discussed office working conditions from a corporate perspective. For example, he stated,

> . . . overall automation strategies must be developed and implemented in order to avoid confusion, duplication, and the possibility that various systems will be put into place that are not compatible, potentially causing the office staff to use incompatible systems to get their overall job accomplished.

The implications of this remark are that no office strategy or the wrong strategy for implementing office automation would be inefficient not only in terms of excess expenditures but also in terms of job stress and productivity.

## B. COMPUTER LITERACY AND TRAINING IN OFFICE AUTOMATION

There was an overwhelming consensus among the three witnesses that as computers get installed in offices--and elsewhere--computer literacy has to improve greatly. The implication was that training in the office would have to be increased to help accomplish this.

In discussing computer literacy, Ms. Wohl declared, ". . . we have not done a very good job at encouraging the formal progress of comptuer literacy, because a lot of it has taken place informally through market forces." She suggested that changes in the tax laws by the Federal Government could speed up such progress. She also highlighted the relationship between computer interfaces and computer training, stating that "the simpler the former are designed, the more painless the latter will be." She illustrated this concept by mentioning

that a bank teller machine is a perfect interface in the sense that if you use it correctly it can give you very tangible and immediate results in the form of money.

Ms. Gregory emphasized her conern that minorities, women, and older workers not be left behind when office managers think about computer literacy. "For example, I know people who are sending their children to computer literacy courses at the age of ten." She continued by saying that these were private courses which some persons will be able to afford and some not. She felt that this "repetition of a theme of polarization" would widen the gap between those who can afford to become computer literate and those who must remain behind because of insufficient resources.

With respect to training per se, this witness emphasized that workers had a basic right to receive training in the emerging technologies and that such training should be provided during working hours at employer expense. In addition, she suggested that Government funding be provided to support training initiatives with regard to the new technology with "funds targeted for those most in need and for industries where computer technology is being introduced rapidly."

Industry has come a long way in technical training, commented Mr. Schrager. "Such training exists at Chase, not only for the technical staff, but also for nontechnical managers, clerks, and secretaries." The witness indicated that Chase was not unique in this respect; other companies also offer extensive internal training programs to retrain current employees who are in occupations being displaced by computers. This opimistic perspective was conditioned by some frustration when he declared:

> Although many businesses purchase the latest in automated office equipment, too often management methods remain rooted in pre-automation techniques due to their lack of training in the potential



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> uses of the technology at hand. . . . training programs must be put into place to prepare the office population and help the transition [to office automation] work smoothly.

Two of the witnesses specifically wanted Government participation in fitting office workers into the computer age; a third said that the private sector has provided needed training in this area and implied that Goverment intervention may be unnecessary. This latter witness qualified his remarks by saying that training has been inadequate to deal with the technology that is coming. In all likelihood, the Federal Government is likely to become involved in computer training simply because a majority of office personnel will be interfacing with information technology in some way over this decade. Since the U.S. Government employs significant numbers of office workers, it may be implied that the Government will have an important stake in office automation.

C. JOB DISPLACEMENT POTENTIAL IN THE OFFICE

While all the witnesses agreed that the coming automation in the office will have important impacts on office employment, each expressed his/her concern in a different manner. Only one of the witnesses appeared less concerned with the potential for job displacement in the office of the future.

The witness representing "9 to 5, The National Association of Working Women," thought that the effects of automation in the office will occur slowly in the United States; however, she was also careful to mention that accumulating evidence suggests that a dramatic loss in office jobs is very possible in the next 10 to 15 years. She pointed out that "while a record 12 million women entered the workforce in the 1970s, an even greater number will seek work--an additional 16.5 million women--in the 1980s." She expressed strong concern

that "the continued need for clerical workers may be masking the potential job-displacing effects of automation in office industries."

Another witness, Amy Wohl, spent considerable time exploring the job displacement question and had differing opinions--depending on the time period being scrutinized. In her testimony, she declared:

> In the short term, there is really no effect on employment at all, that is, we are simply training people to use more sophisticated equipment, and we are not eliminating anyone or ready to hire fewer workers. In some medium-term sense, 2 to 5 years after a company begins to automate, we run into a whole set of computer problems, as major work forces are affected by the process. During that medium term range, we start to see some employment displacement. . . . In the long term, we are going to have major social problems with the fact that there will be fewer jobs after automation is completed or well under way than we would have without automation, and this is going to call for changes in the infrastructure of the whole society. . . .

This witness felt that the rate of office automation will not be slow; rather, because of the cost availability and the ease of use of the new personal computing products, it is going to progress quite rapidly. This will tend to compress the short- and mid-term time frames and make job displacement in the office less controllable.

The final witness in this part of the hearing, Mr. Schrager, emphasized that automation was viewed by the banking industry as a way to reduce staff in the 1960s and early 1970s, and during these years large financial organizations did have many people displaced by technology. However, he said that such is not the case today. "Much of that type of work has been accomplished and few opportunities to do more of the same in the future exist." His rationale for this conclusion was that automation today is being used more creatively--at least in the banking industry--and has become a means of providing a variety of new types of customer services.

## V. MAJOR THEMES CONCERNING THE FACTORY OF THE FUTURE

The last part of the hearing dealt with automation that is evolving in the factory or manufacturing sector of the economy and how factory work is likely to change. Six major themes concerning various facets of automated manufacturing technology and robots emerged in the testimony given by three witnesses--Mr. Dennis Wisnowsky, Mr. George Munson, and Mr. William Bittle. These themes were:

1. International Competition in Industrial Automation;
2. Applications and Utility of Robots and Automated Manufacturing Technology;
3. Impact of Automation on Industrial Employment;
4. Training and Retraining Industrial Workers;
5. Cooperation To Advance Industrial Automation; and
6. Federal Roles in Industrial Automation.

### A. INTERNATIONAL COMPETITION IN INDUSTRIAL AUTOMATION

In recent years several nations have begun to compete--aggressively and effectively--in the world automation market. Their actions in the industrial marketplace reflect the growing recognition of the need to operate their factories in a more productive manner. All three witnesses made explicit reference to the growing international competitiveness in industrial automation.

Mr. Wisnowsky declared that our international competitiveness has declined and that automation is the one chance the United States has to compete successfully

in an area where we were once dominant. In elaborating on the reasons for this, he stated:

> Some have to do with our inability to understand the nature of international competitiveness. Other reasons have to do with the fact that other countries are simply better organized, and to a certain extent, are better equipped emotionally and educationally to deal with the very, very complex problem of industrial productivity.

He noted that other countries competing in the world market have national productivity programs which support basic industries and adopt automation technology in a manner which saves and creates jobs. While he admitted that the United States is slowly positioning itself to tackle its productivity problems, he felt that we do not possess anything resembling a national policy with regard to industrial technology. He further commented that "this may be a reflection of our insistence on a management strategy which adapts to change rather than manages change." To strengthen his contentions, this witness presented a number of examples of the efforts of other nations to improve productivity. For instance, in Japan, a Nisson plant assembles 1300 cars in an 8-hour shift with 67 workers. A West German aircraft plant produces machined parts for fighter aircraft in a totally automated and flexible manufacturing system. The West Germans also have combined with Sweden, Norway, and Denmark in an international automation project targeted at outdoing the Japanese in automation.

"Our economy is no longer young and it is an economy that now faces more economic competition throughout the world," declared Mr. Bittle, another witness in this part of the hearing. He showed concern about what he called "our indiscriminate and unnecessary transfer of technology," which was done primarily by our multinational corporations to increase short-term profits. He believed that such narrow economic criteria of transnational companies is "causing an

erosion of our manufacturing base and is hindering the traditional well-being of the communities dependent on it." The merits of exporting technology, he asserted, should be judged not only on profits but also on the "human and social problems it may create."

The last witness, Mr. Munson, pointed out that the United States has successfully developed automation technology, but has not exploited it as well as our world trading partners. As a result, our exploitation failures are caused by our not creating the business atmosphere of risk-taking. "We are grossly deficient in the way we operate our factories compared with our foreign competitors; the average age of U.S. manufacturing equipment is 20 years while in Japan it is under 10 years."

The witnesses offered a number of rationales for what they saw as increased competition from abroad. They suggested that we have failed to formulate a coherent strategy to counter foreign competition to U.S. enterprises and to provide encouragement to the innovation and transfer processes which brings technology into widespread actual service.

## B. APPLICATIONS AND UTILITY OF ROBOTS AND AUTOMATED MANUFACTURING TECHNOLOGY

Two of the witnesses provided evidence of the substantial role robots and automated manufacturing technology can play in U.S. economic growth with one being very specific about existing and potential applications.

In Mr. Wisnowsky's view, the application of automation technology incorporates the use of robots, computers, and data bases to create information management systems, computer-aided design and computer-aided manufacturing systems, factory control systems, and "intelligent" manufacturing processes. He emphasized that these applications could not only improve output per-man-hour,

but could also contribute to the economical production of a variety of products in small batches, improve product quality, allow faster response to materials and process changes, and permit fuller use of available capital, equipment, energy, and materials. Furthermore, as manufacturing needs change, "robots can be reprogrammed and need not be scrapped when tooling production." In speaking about the factory of the future, this witness commented,

> the real promise of the factory of the future is to provide the appropriate balance of the efficiency of traditional large-scale operations, the flexibility of today's robots on the ship floor, and the effectiveness of tomorrow's computer and integrated manufacturing systems.

The other witness who spoke about applications, George Munson, delineated seven major areas where robots might be applied. These were:

1. Spot welding automobile parts and bodies;
2. Loading and unloading machine tools, die casting machines, presses, etc.;
3. Materials handling and palletizing in diverse industries;
4. Forge shops and foundries;
5. Assembly work;
6. Electrical and electronics fabrication; and
7. Arc welded fabrication.

He illustrated most of these applications by showing film clips of different industrial robots in operation. Not only were the depicted operations described but some impacts and advantages were also discussed.

This witness also described quite well existing installations by saying that they are "islands of automation in which typically one robot tends from one to five machines" and "the trend is to link several such workcells to produce an integrated manufacturing system which is usually more cost-effective." He elaborated further on trends by saying:

> The advanced systems of the robot have the ability to see as well as to coordinate its motion with two moving conveyors. The parts come rather randomly down by conveyor and are looked at by a camara and the intelligence is transferred into the robot's program to instruct it on what the orientation of a part is so that it can now place these parts in a regular fashion.

It appears that both witnesses considered robotics, a relatively new technology, essential to the automated manufacturing process and the factory of the future. In addition, both emphasized the capability of robots to perform a wide variety of tasks in a cost-effective manner. Almost no negative comments were expressed relative to the utility of the emerging industrial technology.

C. IMPACT OF AUTOMATION ON INDUSTRIAL EMPLOYMENT

All three witnesses averred that industrial automation will impact employment and jobs in the factory environment. The two witnesses representing industry appeared optimistic with respect to such impact, while the witness acting as a spokesperson for a union was much more cautious in predicting such an impact.

Mr. Munson stated that the effects of automation on the industrial workplace has already been quite positive. "Millions of new jobs have been created while at the same time the industrial worker's lot has vastly improved." In fact, he mentioned that the robotic industry is probably responsible for 10,000 new jobs and is expected to grow at about 35 percent a year over the decade of the 1980s. This growth, together with expected increases in factory productivity, should generate not only more jobs but better ones, he remarked.

The testimony of Dennis Wisnowsky revealed a perspective similar to that of the above witness. To him industrial automation is not the cause of unemployment--in the auto industry or elsewhere. He mentioned that the 20,000 or so robots at work in American factories may have caused some job displacement, but also have created many new jobs. Further, he stated that "one reason for high unemployment is that robots do not exist in greater numbers." To

illustrate and validate his point of view, the witness noted that in the 1950s there were warnings that computers would cause mass unemployment and that the opposite turned out to be true. In addition, Mr. Wisnowsky quoted a congressional staff economist, Richard K. Vedder, in a report to the Joint Economic Committee of Congress:

> History shows that labor-saving techniques have led to improved living standards, higher real wages, and employment growth. Robotics will raise productivity and with that, the material rewards to employers and employees alike.

The witness from the International Association of Machinists and Aerospace Workers remarked that his most important concern in industrial automation was to ensure national full employment and to help initiate programs to assist in doing so. He testified that:

> With full employment, business would be encouraged to innovate, to introduce new technology, since there would be a market for their products. In the absence of full employment, however, rapid and thoughtless technological change can only exacerbate social problems, especially through the displacement of workers--particularly minorities and women who are just beginning to achieve job levels which permit them to enjoy the benefits of technology.

Mr. Bittle's remarks also reflected the view that the emerging robots and other electronics-based devices being hailed as timesavers could easily result in high unemployment if their introduction was not carefully planned by all parties involved. For example, "layoffs could be avoided provided any necessary reduction in force is permitted to take place gradually through natural attrition--voluntary quits, retirements, and deaths."

## D. TRAINING AND RETRAINING INDUSTRIAL WORKERS

Training and retraining was another prevalent theme in the testimony of the witnesses in this part of the hearing. There appeared to be a consensus that the real issue regarding blue-collar workers in a technologically advancing

economy was training--not in terms of robots per se but, more broadly, in terms of learning to understand and service all the sophisticated computer-driven machines that will be appearing in the manufacturing process. In one way or another, all made reference to the kinds of people that will be needed, including skilled technicians, computer programmers, industrial designers, automation instructors, maintenance experts, marketing personnel, and many different types of engineers.

Mr. Munson stated:

> New programs are required to develop the required curricula, particularly at the vocational school level. Further, subsidies or tax breaks should be considered for in-plant, on-the-job training as well as for company-supported outside programs.

Mr. Wisnowsky pointed out that the workplace is undergoing significant changes and, consequently, a certain portion of the worker's time should be devoted to training. He suggested the possibility of building training rights into the wage structure as vacations and other fringe benefits are today.

According to Mr. Bittle, since new forms of work will be introduced by technology into the factory environment, workers have to be given the opportunity to acquire the knowledge and skills necessary to adapt to this environment. In addition, he stressed that training should be examined within a larger context than has been common in the past. He noted that:

> There will be situations where either the new technology requires substantially fewer workers or present employees are not capable of successful retraining. In these cases, it should be the company's responsibility to train the employee for jobs not necessarily related to the new technology per se. These jobs may be within the existing facility or at other plants of the company or, as a last resort, in the community at large.

E. COOPERATION TO ADVANCE INDUSTRIAL AUTOMATION

In similar ways, each of the witnesses brought out the concept of cooperation among different groups involved in industrial automation. All were receptive to the idea of the public sector and the private sector working closely together in this area.

Mr. Wisnowsky recommended that our Nation combine the best of academia, government, and industry to sponsor joint productivity programs which would test out factory automation ideas. He reminded the subcommittee that this approach was very successful in the space program which also created a number of spin-off technologies, products, and even whole industries. In concluding his testimony he reiterated the need for cooperation, by stating that "we need to begin to change our attitude about ourselves. The best way to do this is to practice working together: government with industry with academia"

Mr. Hanson also brought out the need for cooperation near the end of his testimony when he spoke about leadership roles. He commented that:

> The required leadership [in industrial automation] comes not only from the boardroom--for long-range planning . . . but from Government--to encourage investment in new equipment and new methodologies and to provide incentives for bold and risky actions. It comes also from an enlightened labor force ready and eager to be trained for and take on new jobs created by technological innovation.

William Bittle advocated virtually the same actions when he said:

> The time is now--for trade unionists, for government, for industry--to develop a strategy for dealing with technological change in a creative manner. . . . Through negotiation, employers and employees can develop approaches that humanize both the workplace and the work itself, including the impact of innovation and new technology on workers' jobs, earnings, and futures. . . . We must further recognize that they (problems of automation) cannot be solved by unions or collective bargaining alone. Rather, government, industry, and even the scientific community must join in the development of social policies designed to make working people the beneficiaries rather than the victims of new technology.

The implication of the agreement of all the witnesses, in this part of the hearing, on the need for all societal segments to work cooperatively to minimize economic dislocation that could be caused by technological change, suggests that they would favor increased attention to developing national policies on changes due to industrial automation.

F. FEDERAL ROLES IN INDUSTRIAL AUTOMATION

The need for the Federal Government to play a part in industrial automation also received priority attention by all three witnesses. Part of the potential Federal role was discussed above in terms of the need to work cooperatively with the private sector. They also enumerated other roles for the Federal Government.

Mr. Bittle advocated more and better information on industrial automation and suggested a clearinghouse on innovation and technological change and its effects on the welfare of the American people, on job skills, on training needs, and on industry location as a means of obtaining such information. He stressed that such information could be made available to employers, to unions, and to others upon request and could significantly contribute to solving problems that inevitably arise when automation technology is applied to the industrial workplace. Mr. Bittle implied that the correct facts would help alleviate adversarial positions taken by labor, management, and other concerned parties.

From Mr. Munson's point of view, the major role of the Federal Government is to establish policies which encourage manufacturers--large and small--to invest in automation equipment. For example, he noted that tax breaks and subsidies could provide incentives for the private sector to perform research

aimed at developing new methodologies and to carry out more technology transfers among various industries and disciplines.

Mr. Wisnowsky's suggestions went further on the role of the Federal Government. He stated that in order to create a climate in which general economic growth and growth in the number of jobs could occur, the Federal Government should "provide seed money and leadership for the creation of programs and . . . try out ideas in very big ways--approaching the magnitude of the space program of the 1960s." This witness also recommended tax incentives or tax credits to reward investment in automation by manufacturing firms and commented that these should go beyond accelerated depreciation of capital equipment. "I believe that we should even consider protection or direct subsidies for those industries experiencing unfair competition." Finally, he suggested that the Federal Government encourage technology transfer along the lines of the Stevenson-Wydler Technology Innovation Act of 1980. He noted that "tax dollars are pumped into our Federal laboratories but comparatively little is done to commercialize the products and processes developed in them."